

73 Amateur Radio Today

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**Build a Portable
CW Transceiver
Inexpensive SSB Filters
Techno-Whizzy, Part II**

**73 Reviews
Alinco Simplex Repeater
Down East Microwave's
HF to 70cm Transceiver Kit**

1992 ANNUAL INDEX



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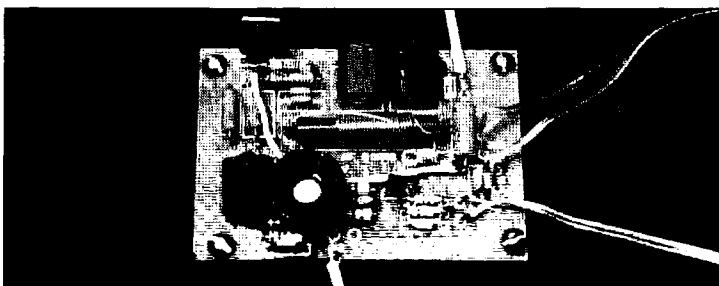
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Cover: The SP-1 transceiver. Cover photo by Mike Agsten WA8TXT.

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Contract: By reading this fine print you have just entered into a binding agreement with 73 Amateur Radio Today to introduce one person to amateur radio within the next 30 days. Why not share some back issues of 73 with them? Invite them into your shack and let 'em make a few contacts. Let us know how you do.

NEVER SAY DIE

Wayne Green W2NSD/1



Being One's Best

While watching one of Perot's commercials a few days before the election, I took particular note of a comment made by both Ross's family and friends that he urged them to not just be good or better, but to be the very best they could be in life. This is a philosophy worthy of consideration. It got me to thinking . . . have I done my best to be the best? How about you?

Here you are, a licensed amateur. That means you've passed the license exam. Did you do it the easy way, by memorizing the Q&As? Or did you buckle down and learn the theory which you were being tested on? And since you've gotten your ticket have you been trying to learn more? I wish I didn't know the answer to that.

As an amateur you have the opportunity to get involved with a wide variety of activities. How much advantage have you taken of this incredible opportunity? Are you marking time through what's left of your life talking about nothing at great length on 2m or one of the low bands?

Being the best in amateur radio means different things to different folks. To me it means learning as much as you can. It means exploring every mode and every band. It means working DX, going on DXpeditions, working packet, RTTY, SSTV, moonbounce, OSCAR, transmitter hunts, ham club work, helping put on hamfests, helping with emergencies, handling traffic, helping newcomers get licensed, building equipment, winning contests, running a repeater, pioneering new modes or technologies, making friends for America in other countries, and even serving your country in time of war.

Then there's being your best at your work. What a shame it is when parents don't teach their children the importance of being their very best. To me that means knowing more about my work than my competitors. It means endlessly doing my homework . . . which isn't actually work because it's fun. It means attending conferences, taking classes, reading books, subscribing to magazines. I just bought a new stack of books and am working my way through them. Some are tedious to read because they're so poorly written, but most are wonderful and give me lots of ideas.

When I took on my responsibility as a member of the New Hampshire Economic Development Commission I refused to let the politicians and their efforts to block the Commission from doing anything of significance hold me back. Ross's idea resonated with me.

Whenever I take up a new interest I tend to go at it whole hog. When I got interested in horseback riding I took lessons . . . and more lessons. I found better and better experts and soon I was teaching riding instructors myself. When I got into sports car rallying I first learned to navigate and then to drive. I developed a new navigation system which filled shelves with trophies. I needed special watches which would keep time accurately all day so I found a factory in Germany to make them for me and I imported them. I discovered a special pepper-grinder-like calculator used in Europe for currency conversions, but which was ideal for rallying. I went to the Curta factory in Liechtenstein and made a deal to import them for rallyists. I developed and printed my own rally tables, which were incredibly simple compared to those made by others. My customers were soon winning all the rallies.

When I got interested in photography I read books, took lessons and spent endless hours in the school darkroom building my skills. I armed myself with everything from 35mm to 5x7 cameras. This helped me greatly when I became a TV cameraman at WPIX in New York and knew how to compose pictures . . . and later when I was a TV director in Dallas and in Cleveland, I helped my cameramen get great pictures. In my early publishing days I took most of my own pictures.

I didn't take up skiing until I was 44, but then I went at it furiously. I took lessons and more lessons. In just a few weeks I was skiing better than I ever thought I'd be able to in my life. So I took even more lessons. Now, at 70, I'm brittle and thus a bit more cautious in the trails I ski since breaking something would be extremely inconvenient, but I still tear down the mountains, having more fun than should be legal.

Somehow my parents got across to me the concept of trying to be the best I could at whatever I got interested in. I've been preaching this idea in my editorials, hoping others would see the

value of this approach to life and adopt it. So how about you? Do you settle for less than the best in what you do? Are you the best at work? Are you achieving your best in amateur radio? Are you learning all you can or are you cheating yourself? When you goldbrick through life you're only cheating yourself.

Let's see, what is there to do in amateur radio that I haven't done yet? What new challenge is there for me? What challenge is there for you? What haven't you done yet? Why not? What are your excuses?

Chess

How's your chess game? Chess is a wonderful game to teach kids because it's totally skill, with no chance element whatever. When you get involved with chess you soon discover that the more you learn about the game, the better you play. A good player will always trounce a lesser player. Ah! So how does one get to be a good player? You do that the same way you get good at anything else . . . you read a lot about it and you take some lessons from an expert. You'll have to memorize hundreds of openings, and thousands of end-game closings. You learn to be aggressive or lose. The fact is that the game of chess is a wonderful teacher for life. It'll teach you the fundamentals of business. You'll learn to do your homework, be aggressive, and look for creative new approaches to old situations. You'll learn the value of persistence.

Go is another game of skill and its popularity in Asia has a good deal to do with the way the Asian countries have been running circles around us in business. Chess and Go teach qualities which are valuable to a country. They help teach the work ethic. You don't win at chess unless you work at it, but if you do you'll surely win. That's great training for life.

Fear

One thing that's been bugging me is why so few hams have actually tried packet radio. I wonder if it has something to do with fear? A fear of embarrassment of making mistakes when you're into something completely new? A fear of displaying your own ignorance of both radio and computers? A fear of the unknown?

It isn't as if it costs much to get in-

involved with packet radio. And it isn't as if you don't know that there are several thousand hams having a ball with it.

So let's look at this fear thing and see if we can understand it better. People generally fear things they don't understand, right? So let's look at the other side of that coin. Are there any things you understand that you fear? I said fear. I'm not afraid of electricity, I respect it. I've gotten knocked on my kister a couple of times and that's generated a surprising amount of respect. But it's not fear or terror.

Once we take the trouble to find out more about the things that we are afraid of we no longer are afraid. I'm afraid when I'm walking on a New York street at night and a group of black or Hispanic teenagers pass me. I'm afraid because I don't know whether they are dangerous or not. It's the unknown. If I were to take the trouble to get to know them I would no longer be afraid.

The next time fear hits, perhaps you can consider that if you understood what you are afraid of you wouldn't be afraid. So, instead of fearing and probably running away or avoiding, try to find out more about what has frightened you . . . knowing that this will eliminate your fears.

Religions rule billions of lives through fear. Fear of punishment for sins. Fear of the devil, of hellfire, and so on. I can't fault them for that because it pays off. It pays off in billions of dollars. We have some extremely wealthy religions, all built on fear. But you know, we haven't a shred of proof that any of these fears are real. Millions of people believing things doesn't make them true, otherwise the sun would still be spinning around the earth and Columbus would have fallen off the edge of the world.

Now, are you ready to give packet a try? It's wonderful fun and you're missing a whole big piece of our hobby. Yes, of course you're going to have to learn a lot. And you're going to make all kinds of dumb mistakes. Hey, there's always a first, right?

Step two . . . I expect a letter from you thanking me for pushing you into this.

Reason Prevails

The League has backed down on their opposition to automatic relaying on the low bands. I'll let the packeteers give you the gory details on what happened.

I can understand concerns about the blind relaying of messages, where there would be a strong possibility of jamming contacts already in progress. This is much like K1MAN or W1AW coming on their self-assigned frequencies and broadcasting blind.

Most of us pick what sounds like an unused frequency and then ask if anyone is using it before we launch into a long CQ. Perhaps the packet software developers can get our packet (and RTTY) systems to emulate this approach. If a relay station could send a short coded signal which would ask if

Continued on page 66

From the Hamshack

Joel Weder VE6VOX, Calgary, Alberta, Canada I was reading my July/August copy of *The Planetary Report* (published by The Planetary Society, which promotes space exploration) and came across a rather interesting article, "Doing More With Less: The New Way of Exploring the Solar System," by Rex Ridenoure. The article discussed the trend towards smaller and more cost-effective space probes. What's interesting about it for you and me is his description of the rate of technological change involved: "... the SDI and commercial space segments are three to five years ahead of the space exploration field in developing and applying new satellite technology; these groups were preceded by the academic and amateur radio communities."

These days everyone (Wayne especially) seems to be wondering where amateur radio is going—what will be our reason for being. Well, I think this article just shone a little light on the path. There are still hams experimenting at the forefront of technology, whether it be with OSCAR, packet or repeater linking via satellite. The club that I recently joined here in Calgary (CARA) is one of the most progressive I've seen because (it seems to me) they keep politics to a minimum, aren't afraid to jump into a new project and concentrate on getting things done. Those are, as any good businessman knows, among the central keys to success.

I recently gave up a well-paying job as a military photographer to go to college. Most of my friends think I'm crazy to do such a thing during a recession, but when I graduate as a telecom technologist it'll "open a whole new world" to me. I guess my point is that we, as amateurs (and North American society as a whole), need to be willing to take chances on change and innovation. We cannot allow ourselves to continue being afraid of the future.

David K. Hansen KBØEVM, Jeddah, Saudi Arabia Greetings from Jeddah, Saudi Arabia. Amateur radio is pretty limited here, although the Oasis Amateur Radio Club has been in operation since last February. The call is 7Z2AB and our QSL manager is AAØBC. There are about 15 hams on the roster and many activities going on. The equipment includes an ICOM 725; a Kenwood 440S; beams for 12 and 17 meters, and for 10, 15, 20 and 40 meters. Our hours are somewhat limited, but any availability of operation is appreciated. As you can

imagine, we usually get quite a pile-up when we get on the rig.

I have been here for eight years, arriving as a private and commercial pilot ground instructor and have moved to being the senior instructor for 747 avionics systems instruction for the flight crews. My former occupation was as a physics teacher in a high school in Minnesota. Wayne, I do agree with some of your conclusions in your editorials concerning the education of youth. However, it is easy to use a big brush and to think every classroom is the same. There is a lot of quality out there. Granted, there may be less than in previous decades, and the objectives of education may not be appropriate to today's required work force. So, why am I not still in the classroom? I had given a lot of effort to the students, received several awards for teaching excellence, and received little support from the local administration. I did what I wanted to do, did well, but received nothing extra beyond what an "average" teacher would receive. Finally, teaching college placement physics, standard physics, and aerospace; and acting as radio club advisor, chess club advisor, faculty social committee chairman, athletic field manager and science department chairman wiped me out. The number of students increased and the money available for supplies went down. How do you teach physics when the annual money per student for all supplies is less than a meal for two at McDonald's?

Until the business world and the public want to have responsive, quality schools and are willing to support appropriate school goals emotionally and financially, there will be little change. I did get tired of music departments getting personal computers to maintain inventories of instruments, uniforms and candy sales while the science department uses instructor-purchased computers. It was that or have none. But then, music and athletic departments have their parent support groups. Maybe there should have been a science concert some evening.

There will continue to be young dreamer teachers, there will be those who sacrifice their own family time to do a good job, but somewhere around the 30- or 40-somethings they look in the mirror and make some inner comment about "what is this getting me?"

Let me get off the soap box and to the main reason for writing. Being here I can appreciate the restrictions on radio operations. I only hope that amateurs are picking up the baton

and doing something about getting young people interested and upgrading their own skills in a few of the multiple areas of amateur radio. A suggestion I would make is to adopt a library, either a school or public library. Make it a normal practice to donate a book on electronics or amateur radio on each of your birthdays or on July 4th as a birthday gift to the country. Skip that meal out in the restaurant and donate a book instead. Send the XYL a card and tell her that her flowers were converted into a book. Encourage others to do the same.

Fred E. Piering WD9HNU, Maitland FL My God! Wayne, what's this world coming to? Since the birds have left the nest, my wife has contemplated starting a small business, such as a grocery shopping and delivery service for the elderly or infirm (she likes to spend other people's money—read: mine). So, when I read your editorial in the November issue I showed her the section you wrote concerning "Making a Buck." When I found her reading page 76 I inquired, "What are you doing?" She responded that she found you very interesting and profound, very informative!

She asked how long you had been writing editorials and I told her 30+ years that I could remember (I still have some 73s from the beginning). Well, now I am under strict orders that from now on when I receive my 73 in the mail, I am to turn it over to her so she can read your editorials. Maybe she should pay for the next subscription?

L. E. Dickason N8MKM, Jackson OH Wayne, your June editorial requires some comment. I agree that 20 wpm is a little silly in our digital world. I am a Tech with 5 wpm, but I really can't see the value in suffering through the code to upgrade. Why not a series of tests which emphasize theory, rules and COURTESY?

I started reading 73 as an SWL because you had good articles on antennas and other topics and because you didn't talk about SWLs as if they were vermin. It takes more than glossy paper to make a magazine.

Speaking of high-tech, I would like to build a digital signal processor and a panadapter or spectrum analyzer. Where are the projects? I enjoy "Above and Beyond" because it pushes my understanding to the limit. Isn't that what it's all about?

Guy Metrocavich, via Instinet I thought Sheets and Graf's article titled "ATV Transmitter, Part I" (August 1992) was great. I enjoyed the thorough yet concise circuit description. For example, the description of the Q1 oscillator gave me all I needed to understand how it worked.

I have seen this oscillator in cir-

cuits for years and never figured it out. I always looked for feedback from the emitter or collector to the base; I did not realize it was a common base configuration.

The rest of the article was equally insightful. Thank you.

Jim Kocsis WA9PYH, South Bend IN Wayne, I thought I'd better write to you and let you know that I've been taking some (not all!) of your advice. First of all, I'm a subscriber since 1965 so I'm a long-time reader of 73.

Ham radio is alive and well in our town and I'm fairly active, but I thought I would share some info with you and 73's readers on non-ham-radio subjects. I read a lot and have read some very interesting books in the past few years. There are much more interesting things and thoughts going on in the world than what the AP, UPI, etc. think we should know.

Why am I mentioning this in a ham radio magazine? Only to prod people to talk about more interesting things than RST, the rig, weather, QSLs, etc. My gosh, we have a "meeting room" that spans the country (actually the world!) that we can use 24 hours a day for free and we are not doing it! I've tried skipping the rubber-stamp QSO format and have had some excellent discussions with fellow hams. I heavily recommend this to the readers of 73.

As far as TV is concerned, I personally only watch a few shows regularly. I want to be informed or entertained (made to laugh, not depressed!). What can you do in your spare time if you don't want to yak on the air? Anything! But don't waste your time doing the same thing over and over and over again. My gosh, we're not robots (or are some of you?). And if you can't read when there is time (my eyes get tired at night but I still feel like I need some input) there are tapes at your local library that are instructive, entertaining or just pleasing to the mind. Did you ever try listening to one of those subliminal tapes (weight reduction, controlling anger, dealing with angry people—the list is endless)? Did you ever try listening to a tape on self-hypnosis? Or music from another culture? There are tapes that are condensed versions of some very good books.

Now, after you've read something off the beaten path, try telling someone you contact on the air about it and discuss it—you will be pleasantly surprised by their reaction! Ditto for people at work. Mostly what I've heard is: "Gee, I always wanted to know about that . . . but I never had the time."

How about it Wayne, am I right? The most exciting things are the unknown and the new, not the same old same old.

Please keep "on our cases" Wayne, we need the constant motivation!

The Emergency Broadcast System Today

Hearing "this is only a test" broadcast by your local radio station may become a thing of the past. The FCC has announced a "comprehensive attic-to-basement" plan to overhaul the Emergency Broadcast System (EBS). EBS has not been updated since 1976. Its name may be changed to the Emergency Warning System (EWS).

Proposed is a new form of silent testing and a cutback (from weekly to monthly) in the amount of on-air testing. Actually, new equipment will be able to test itself.

The FCC is suggesting a new "subaudible" warning system that will preclude using the familiar 20-second tone that mixes 853 Hz and 960 Hz together in order to activate emergency listening devices.

Cable operators, who currently do not have to perform EBS tests, will be required to join TV and radio broadcasters.

In 1991, EBS was used more than 1,500 times. The Emergency Broadcast System was activated nearly a day before Hurricane Andrew hit the south Florida coast.

EBS was established in 1951 as the CONELRAD (Control of Electromagnetic Radiation) system during the Truman administration to provide the president with the means of addressing the American people in the event of a nuclear attack. The service has yet to be used during a national emergency.

The Truman administration envisioned that the President or a government agency would activate the tone to control a master radio or television station, one specifically constructed to withstand an atomic explosion. The station's command tone would be heard by other stations, linked in a pyramid: Those stations would be heard by other stations, and so on.

Currently, EBS is only used at the local level to notify the public of dangerous conditions: toxic leaks, tornadoes, hurricanes, chemical fires, earthquakes, floods and such. The EBS was even used during the LA riots to call off-duty police officers back to work. *TNX The F.O. Flyer, October 1992.*

Youth Forum Interviewees Needed

Carole Perry WB2MGP is seeking articulate, active amateur radio youngsters up to age 18 to be interviewed for various youth forums across the country.

Please contact Carole at P.O. Box 131646, Staten Island NY 10313-0006, or call her at (718) 983-1416.

Congress Enacts New Restrictive Scanner Law

The law prohibiting the manufacture of scanners with (or easily modifiable to include) the cellular bands passed the Senate (reportedly *without* debate) on October 8th. The "cellular ban" was an amendment to the FCC funding bill and it is entirely possible and even probable that most senators had *no* idea the cellular amendment was there or what it meant. The following comments, which have appeared in several places, are speculation until an official interpretation is published:

(1) Receivers with external converters, lab-type receivers and tunable receivers are *not* affected by this law. *Scanners* are affected. Once the law goes into effect (180 days from October 8, 1992), no scanner can be manufactured that will cover the cellular bands, nor can it be made to be easily modified.

(2) It looks as though as long as the scanner is made with a *continuous* large frequency range, you can include the cellular frequencies.

(3) This law *does not* affect used scanners or scanners that were manufactured prior to the effective date of the law.

Here is the exact text of the new law:

Sec. 408. INTERCEPTION OF CELLULAR TELECOMMUNICATIONS.

(a) **AMENDMENT**—Section 302 of the Communications Act of 1934 (47 U.S.C.) is amended by adding at the end the following new subsection:

(d)(1) *Within 180 days after the date of enactment of this subsection, The Commission shall prescribe and make effective regulations denying equipment authorization (under Part 15 of Title 47, Code of Federal Regulations, or any other part of that title) for any scanning receiver that is capable of—*

(A) *receiving transmissions in the frequencies allocated to the domestic cellular radio telecommunications service,*

(B) *readily being altered by the user to receive transmissions in such frequencies, or*

(C) *being equipped with decoders that convert digital cellular transmissions to analog voice audio.*

(2) *Beginning 1 year after the effective date of the regulations adopted pursuant to paragraph (1), no receiver having the*

capabilities described in subparagraph (A), (B), or (C) of paragraph (1), as such capabilities are defined in such regulations, shall be manufactured in the United States or imported for use in the United States.

[By Roy J. Cloutier, adapted from public postings on Prodigy. *TNX Westlink Report #637, November 12, 1992.*]

Space Symposium a Great Success!

The Tenth Annual AMSAT-NA Space Symposium and meeting was held at the beautiful Intelsat Headquarters building in Washington, DC, on October 9-11. The 300 in attendance heard presentations on such diverse subjects as antenna testing for the Phase-3D spacecraft, use of the PACSATs, SAREX hardware configurations and the AMSAT awards program. Once again this year, the ARRL co-sponsored an educational workshop at the Symposium. A complete satellite station that was installed for the weekend was used to make several AO-10 and AO-13 contacts, including a scheduled QSO with a special event station at the AMSAT-Denmark meeting being held in Copenhagen.

Dr. Ron Parise WA4SIR was the banquet speaker. He entertained the audience with a talk, slides, and a movie detailing the Astro-1 space shuttle mission on which he was a payload specialist and SAREX operator. The evening ended with presentations of awards and a drawing for the numerous door prizes that were generously donated by many different companies.

The printed proceedings (32 papers, almost 300 pages total) are available from AMSAT-NA Headquarters. Look for a detailed report on the meeting and symposium in the next issue of the *AMSAT Journal*. *TNX AMSAT-NA; Westlink Report #637, November 12, 1992.*

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The Techno-Whizzy 1, Part II

Build a direct digital synthesis (DDS) transmitter.

by John Welch N9JZW

In Part I of this article, we built the VFO, frequency selector and power supply boards. Using just these, you have a very QRP transmitter (2 milliwatts) or a nice signal generator. For those who like a transmitter with a little more oomph, here's the amplifier stage.

Since we've gone through a lot of trouble and expense to generate nice, clean, pure sine waves, it would be a real waste to run it through a class-C amplifier. Class C would also require a filter for every band or two, complicating things even more. Class A is the right approach (with the added benefit that when we make the TW-1 do SSB we won't need a new amp).

Designing a class-A power amplifier wasn't easy (digital likes me; analog hates me). The amplifier was designed to be easy-to-build, requiring no adjustments. It is not, however, the most efficient or powerful design. The amplifier will remain linear down to about 10 volts, and remain within maximum specs up to 13 volts. It is designed to run from a freshly-charged 12-volt battery or 13.8-volt power supply. More than 13.8 volts won't give you more power—it will just burn up the final amp!

Class A has its drawbacks—namely, it consumes more power than class C and consequently also runs hotter than class C. I've sidestepped this issue by keying power to both the driver and the final stage, so it will only consume that power and generate that heat while you have the key down. This also sidesteps another common problem—stray RF getting into the final and being amplified to a low-level signal.

Theory of Operation

The RF signal at about 1.5-2 mW comes into the base of Q2 at J2. Resistors R5, R3 and the transistor combine to present a 50-ohm load to the input. Emitter resistors R6 and R7 keep the driver Q2 stable, limit current flow and, combined with bypass cap C3, provide some frequency-dependent output compensation. The output runs through C2 to a 4:1 step-down transformer, T1. This transforms the 50-ohm output to a 12.5-ohm input to the final amplifier. C10 keeps the DC bias provided to Q3 by R6 and R9 isolated from the transformer.

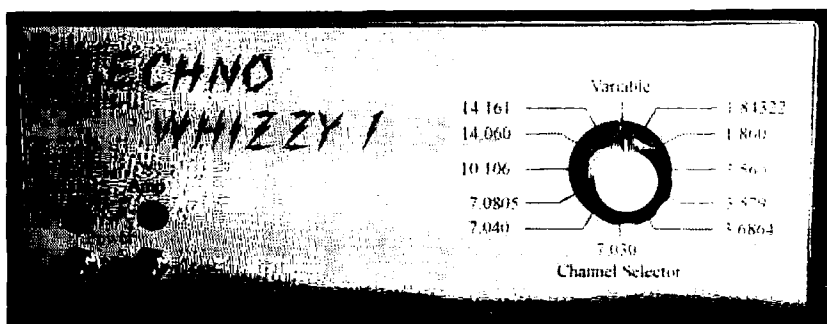


Photo A. The front panel of the Techno-Whizzy 1 DDS transmitter.

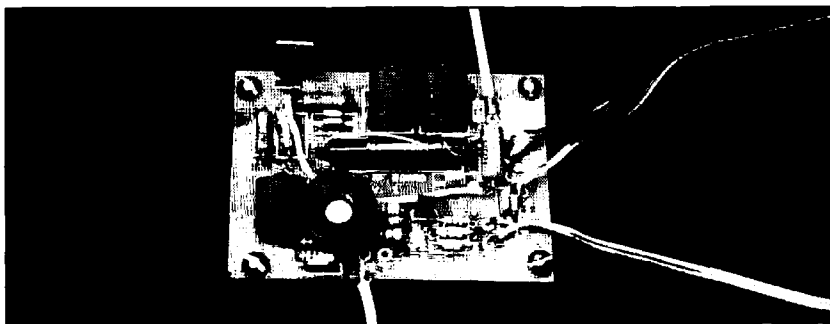


Photo B. Close-up view of the power amplifier module.

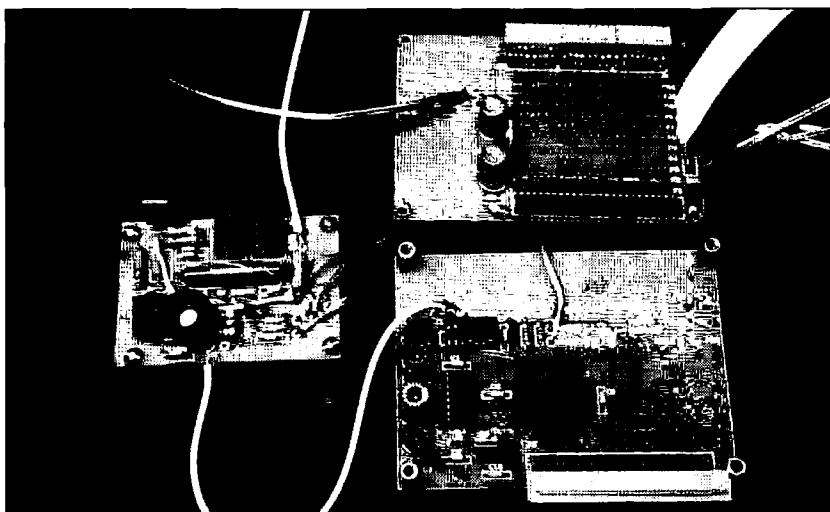


Photo C. Hooking up all of the modules together to complete the Techno-Whizzy 1.

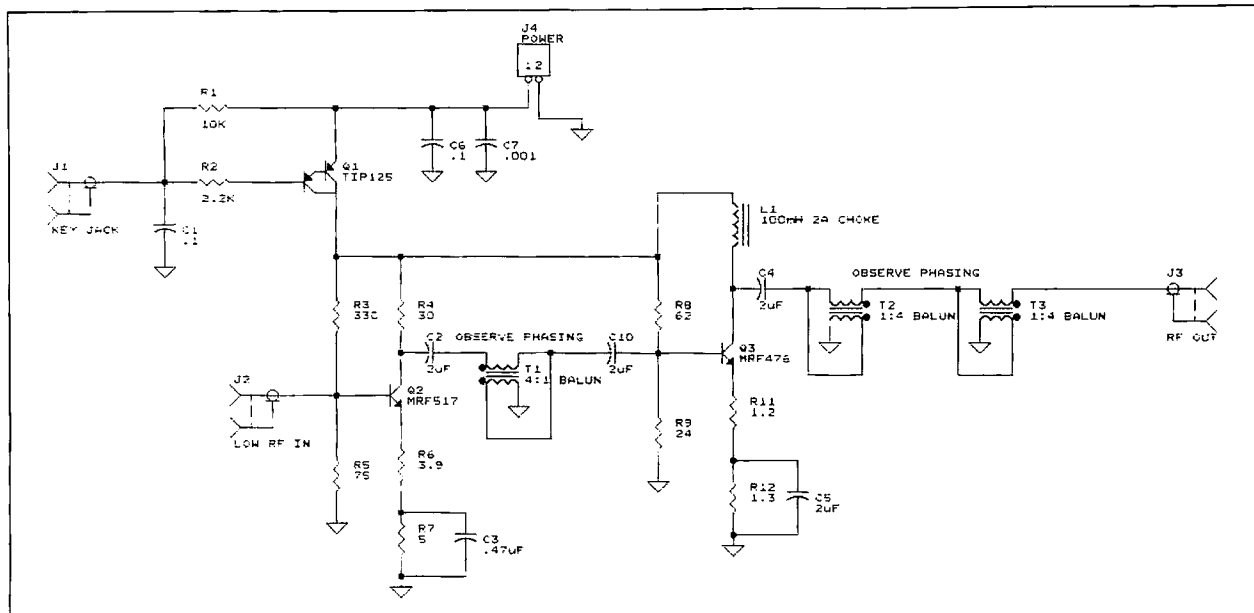


Figure 1. Schematic diagram of the power amplifier board.

Choke L1 provides power to the final amplifier, Q3. Emitter resistors R11 and R12 keep the final stable and provide limited output compensation with C5. The output flows through C4, into the 16:1 matching network of T2 and T3, then to the antenna connection at J3.

Power comes into the keying circuit through J4, the Transmit/Receive switch on the front panel. Capacitors C6 and C7 bypass RF to ground. The key is connected to jack J1. The unit is keyed by grounding Q1 through R2. R2 and C1 help in shaping the keying waveform, preventing sharp edges. Power to both the driver and final is keyed, keeping the power drain and associated heat to a minimum.

Construction

The amplifier board should deliver about a watt of clean signal into a 50-ohm load. To do so will require you to wind some balun cores into transformers. There are three on this board, all 4:1 baluns using BN-43-202 cores. Winding them is a lot easier than explaining how, so take courage.

To wind the transformers, take about six feet of 30-gauge magnet wire and fold it in half. Putting one end in a vise, twist the wire to about 15 turns per inch (I used an electric screwdriver for this and it went very quickly). Wind this twisted wire up through the left hole of the balun core and back through the right. That's one turn. Go back in through the right and back out through the left, for two turns. Continue, winding eight to 12 turns on the core, leaving wires coming out of each hole at the bottom. Now cut the folded-over tip in the middle, making it two wires wrapped around each other.

Scrape back some insulation on the ends of the wire and use an ohmmeter as a continuity tester to identify the two wires. Twist the left-hand side of wire #1 to the right-

hand side of wire #2. The left-hand side of wire #2 will go to ground, and the signal goes between the twist and the right-hand side of wire #1.

Now that you've got the transformers wound, install T1 on the board. Orient it so that the twisted end is in the middle, and one wire goes to ground and the other wire goes to Q2 (on the board, the "twisted" end is the two holes that are shorted together). This steps the 50-ohm output of Q2 down to 12.5 ohms into Q3.

Install the other two baluns at T2 and T3. Here again the twisted ends go in the middle, with one wire to ground and the other wire towards the output. These provide a 16:1 step up from the 3.125-ohm output at Q3 to 50 ohms at the antenna jack.

J1 is the input from your key. Hook this to a jack with a chunk of two-conductor wire or RG174 coax. J4 is the 12-volt power input. Hook this to a power input jack (if fused, use a 2-amp fuse). J2 is the RF output—attach this to the output jack (SO-239 preferred) with some more RG174. J3 is the RF input from the DDS

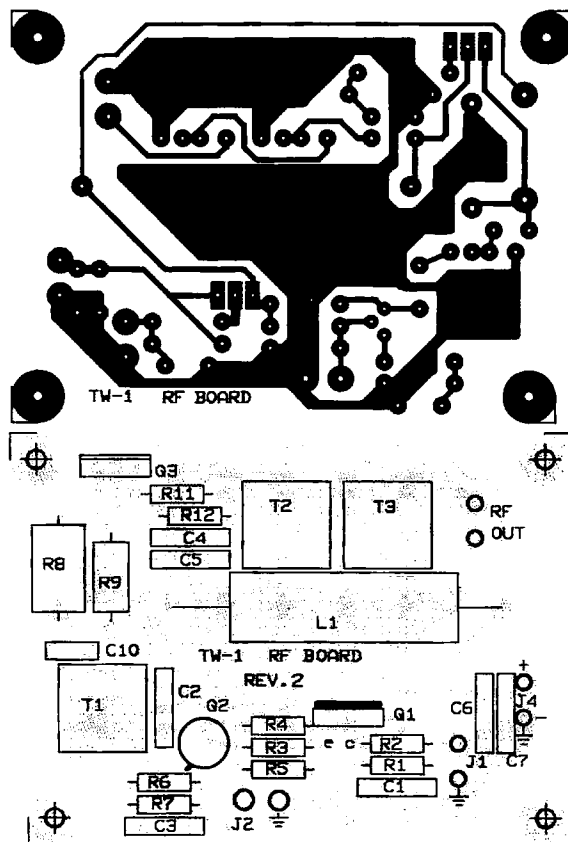


Figure 2 (a). PC board foil pattern of the power amplifier board. (b). Parts placement.

VFO board—leave this vacant for now.

SW1 switches power from receive to transmit. As the amplifiers are class A, they consume a lot of power just sitting there. Leaving this stage powered down while receiving will cut the TW-1's power consumption to a trickle.

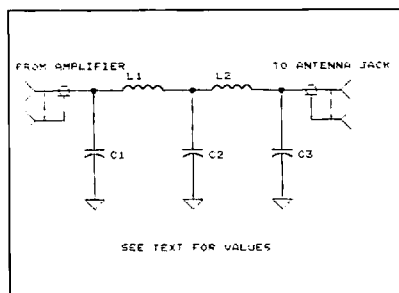


Figure 3. Schematic diagram of the optional output filter board.

Install the transistors next, matching the shapes to the shapes on the board to assure proper pin arrangement. Q1, the TIP125, shouldn't need any heat sink, but Q2 (an MRF517 or 2N3866) will—a top-hat type will be adequate. The MRF476, Q3, also needs to be heat-sinked, preferably to the back panel of the radio. Be sure to use thermal goop, a mica insulator and a nylon screw to attach this transistor to the case. For testing, you can use thermal goop and a TO220 heat sink, but don't run it for long!

By now you're almost done. Just install the rest of the parts. They're all passive components so there is no "backwards"—but be sure to get them in the right spots! As always, double-check your work.

Attach a dummy load (50 ohms 5 or more watts will work fine) to the SO-239 RF output connector. Turn SW1 to "transmit" to apply 12 volts to J4. Attach your voltmeter to the "hot" end of R5. With the key jack open, you shouldn't read more than 0.1 volt. With the key jack shorted, you should read around 2 volts. A small difference is

Continued on page 85

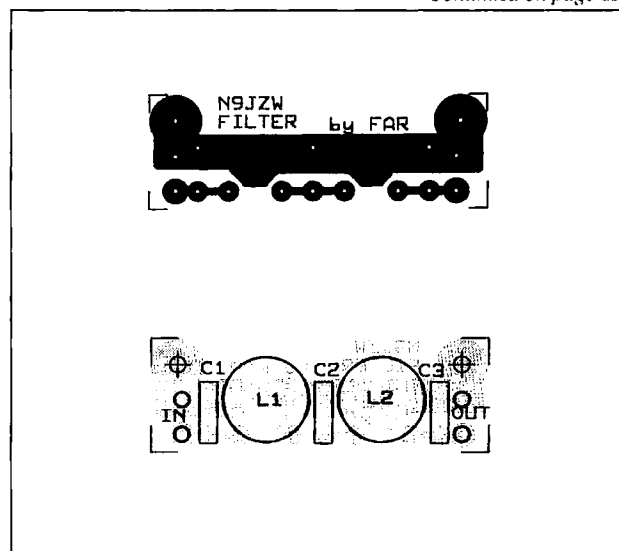


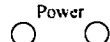
Figure 4 (a). PC board foil pattern of the output filter board. (b). Parts placement.

Table 1.

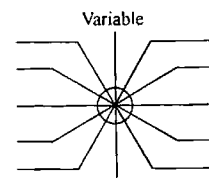
Band	Component Values for the 5-Pole Harmonic Output Filter				Winding Information
	C1,C3	C2	L1,L2		
160m	1000 pF	2700 pF	6.55 μ H	36 turns on a T50-2 toroid core	
80m	470 pF	1500 pF	3.08 μ H	25 turns on a T50-2 toroid core	
40,30m	220 pF	560 pF	1.19 μ H	17 turns on a T50-2 toroid core	
20,17,15m	100 pF	270 pF	0.568 μ H	12 turns on a T50-2 toroid core	

TECHNO WHIZZY 1

Main Aimp



By N9JZW



Channel Selector

Figure 5. Front panel pattern for the Techno-Whizzy 1. Blow up this figure with a copy machine to fit your cabinet.

Parts List: TW1 XMIT Linear Amplifier

Item	Quantity	Reference	Part
1	2	C1,C6	0.1 μ F ceramic
2	4	C2,C4,C5,C10	2 μ F ceramic
3	1	C3	0.47 μ F ceramic
4	1	C7	0.001 μ F ceramic
5	1	J1	key jack
6	1	J2	low RF in
7	1	J3	RF out to antenna
8	1	J4	power 12 volts in
9	1	L1	100 mH 2A choke from Radio Shack
10	1	Q1	TIP125
11	1	Q2	MRF517 or 2N3866
12	1	Q3	MRF476
13	1	R1	10k ohm 1/4 watt
14	1	R2	2.2k ohm 1/4 watt
15	1	R3	330 ohm 1/4 watt
16	1	R4	30 ohm 1/2 watt
17	1	R5	75 ohm 1/2 watt
18	1	R6	3.9 ohm 1/4 watt
19	1	R7	5 ohm 1/4 watt (4.7 will work)
20	1	R8	62 ohm 1 watt
21	1	R9	24 ohm 1/2 watt
22	1	R11	1.2 ohm 1 watt
23	1	R12	1.3 ohm 1 watt
24	1	SW1	T/R switch DPDT toggle
25	3	T1,T2,T3	4:1 balun on BN-43-202 core

Note: A complete kit of parts (including the PC boards) is available from Elkronics Northeast, Rt. 1 Box 789, Hancock NH 03449. Phone: (603) 525-4001. Prices as follows: DDS VFO module — \$99; Diode Matrix module — \$49; Power Amplifier module — \$49; Output Filter module (specify band) — \$10; A complete package of all modules — \$199. The Qualcomm Q2220 DDS chip can be ordered separately for \$39. All prices include postage.

Etched and drilled PC boards for this project are also available separately from FAR Circuits, 18N640 Field Court, Dundee IL 60118. Pricing: DDS VFO PC board — \$8; Diode Matrix PC board — \$8; Power Amplifier board — \$6; Output Filter — \$3. Please add \$1.50 per order.

The Q2220 (as well as data sheets) is available directly from Qualcomm, 10555 Sorrento Valley Rd., San Diego CA 92121; (619) 597-5005. The price is \$49 (1-24 qty.); \$150 minimum order.

The CA3338A, the 55 MHz clock oscillator and most of the small parts are available from Digi-Key; (800) 344-4539.

Toroids are available from KA7QJY Components (Danny Stevig), Box 3893, Logan UT 84323; Tel: (801) 563-5173.

Programmable-Frequency Audio Generator

High accuracy with digital control.

by Loyd W. Redman

Most audio signal generators built around IC timers or op amp oscillators require some external capacitors and resistors to determine oscillator frequency. To obtain high accuracy of an output frequency, the external capacitors need to be adjustable. If the oscillator is to have several frequency ranges, you'll need several external capacitors in addition to trimmers for fine frequency adjustments. Some capacitors change value with aging, so manual adjustments must be made each time the generator is used.

Digital Audio Frequency Control

Micro Linear makes the ML2035 and the ML2036 IC sine wave generators needing

only one external component, a crystal. The frequency is digitally controlled, so no external capacitors need to be adjusted to change frequency ranges or to fine-tune a selected frequency. Figure 1 shows the schematic of a programmable-frequency audio generator using either the ML2035 or the ML2036 ICs.

The heart of both the ML2035 and the ML2036 is a DAC (digital-to-analog converter). We enter a 16-bit digital word serially and get a sine wave output. Refer to Figure 2 and we'll review the operation of a simple DAC. The output directly from our basic DAC is not a nice smooth sine wave, but a triangle wave. The triangle wave is ac-

tually a series of voltage steps, not the smooth waveform we would see when an oscillator output is derived from the voltage at a capacitor terminal.

Here's how the voltage steps are generated. The circuit of Figure 2 can be viewed as an operational amplifier wired as an inverter, with separate digitally selectable input resistors. The voltage gain equation for an inverting op amp is: $A = R_f/R_{in}$. Our switches are SPST electronically controlled, solid-state switches. Suppose the digital control word contains four bits. We then have 16 possible output voltage steps. When the digital word is 0001, S4 is closed, connecting +10V to

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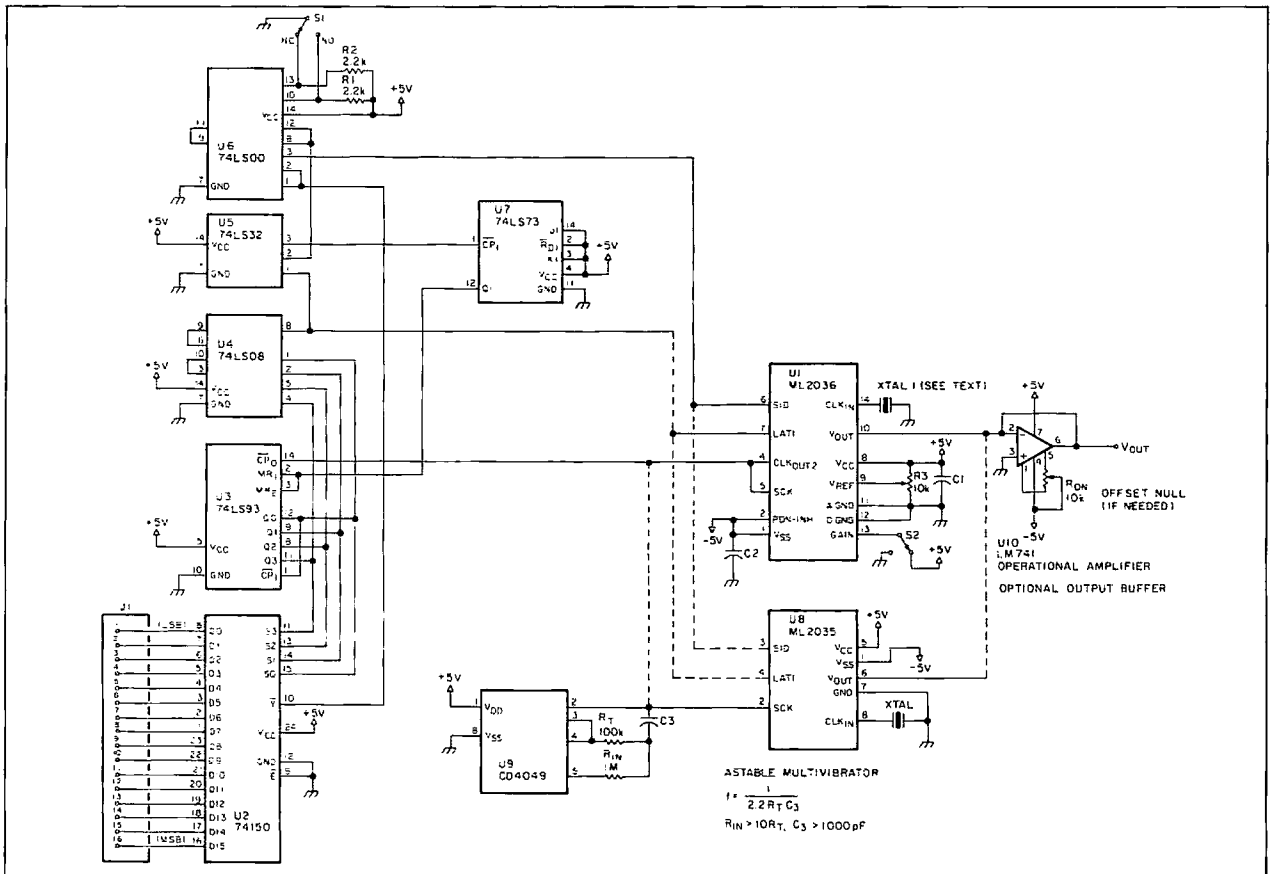


Figure 1. Programmable-frequency audio generator circuit diagram using the ML2036 or the ML2035. Dashed lines indicate changes in wiring when using the ML2035.

Programmable-Frequency Audio Generator *Continued from page 16*

the end of the appropriate resistor in the network so the gain of U1, R_f/R_{in} , becomes $1/16$ or 0.0625 . The output voltage will be $0.0625 \times 10V$ or $0.625V$. Thus, the second output voltage step will be $1/16$ of the reference voltage. If our up-counter begins at 0000, the 10V reference is not connected to U1, so the first voltage step is 0V. Our word generator continues to enter digital words in sequence to 1111. At a count of 1111, switches S1-S4 are closed, connecting resistors in the network to produce an amplifier gain of 0.9375 and an output voltage of $9.375V$, $15/16$ of the reference voltage.

At this point you may ask, "Where's the rest of the triangle wave?" With digital control words of 0000 to 1111, our output is only one quadrant of the triangle wave. Our control logic now directs the word generator to count down in the sequence 1111 to 0000. This will get our output steps back to 0V. Now we need to generate the negative-going half of the triangle wave. The sign bit from our word generator causes the control logic to change the position of S5, disconnecting the input to U2. The word generator counts up, then down, producing the negative-going alternation of our triangle wave.

If we apply an 8-bit digital control word and modify our switches and input resistors, we can produce an output voltage of 128 (2^7) steps. The 8th bit is used as the sign bit. We observe that the more voltage steps we have, the nearer the output of our DAC resembles a true triangle wave.

We could use a triangle wave as an audio test signal but the results wouldn't be as satisfactory as if we had used a true sine wave. Figure 3 shows a comparison of amplitudes between a triangle wave and a sine wave, one quadrant only. You can see that at an angle of about 55 degrees, the difference in amplitude between the two signals is about 2V.

The ML2035 and the ML2036 add two important blocks to our basic DAC that give us a near-ideal sine wave output. (Detailed spec sheets are available from Micro Linear, 2092 Concourse Drive, San Jose CA 95131.) The first of these functions is a sine look-up table. Remember back before the advent of hand-held calculators, when your math text contained tables of sine values for angles 0 degrees to 90 degrees? The sine look-up table is in the form of a read-only memory (ROM). The instantaneous value of the output voltage is derived from the value of the sine of an angle that is a multiple of $90/128$, or about 0.703 degree. The output waveform is still a series of voltage steps. You can observe these steps with your 'scope if you operate the circuits with a clock input much slower than the recommended minimum of 3 MHz.

The second added block in our circuit appears just before the output. This block is a low-pass (smoothing) filter. Many of the internal functions of the ML2035 and the

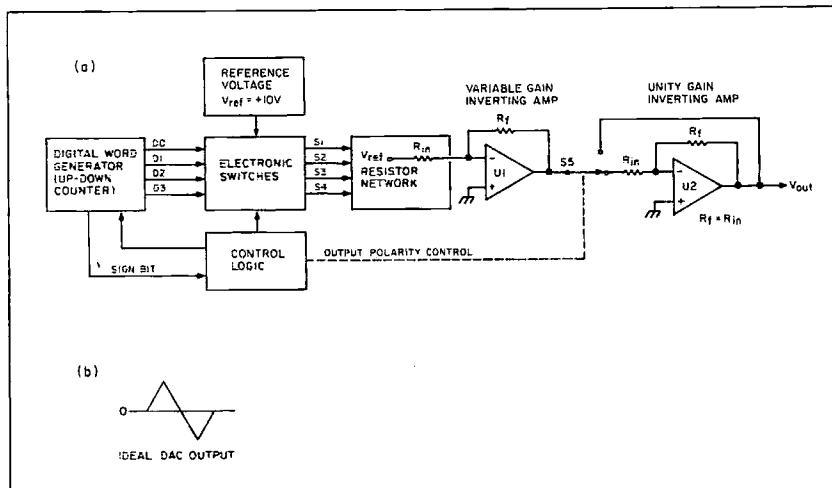


Figure 2. Block diagram of a basic digital-to-analog converter (DAC).

ML2036 operate at $1/4$ clock frequency, 750 kHz, if our crystal is 3 MHz. Since we're interested in frequencies of 20 kHz or less, the low-pass filter removes most components of the higher frequency that are "straying" around in the close confines of our integrated circuits.

How the Circuit Works

At initial power on, our circuit does nothing and we observe these conditions: The Q1 output of U7, a J-K flip-flop, is high. This high, connected to the master reset pins of U3, a 74LS93 4-bit binary counter, causes all the outputs of the counter to be low, 0000. With the master reset pins high, count is inhibited even though the 74LS93 is being clocked by the pulse train from pin 4 of the ML2036. The CLKout2 signal frequency is $1/8$ our crystal frequency.

After we apply the 16-bit word to J1, circuit action is started by depressing and releasing S1. This sends a momentary high to one input of U5, a quad two-input OR gate, bringing pin 3 of U5 high, toggling U7. The Q1 output of U7 connected to the master reset pins of our counter goes low, enabling the 74LS93 to start counting.

Now that we have the circuit action start-

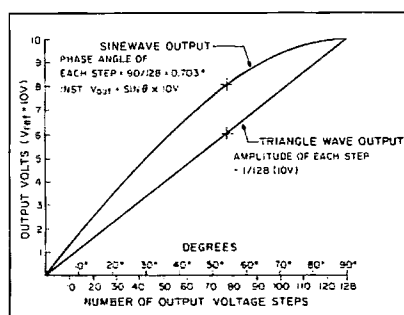


Figure 3. Comparison of one-quadrant output voltages from a DAC.

ed, we'll describe how we use the ML2036 since it has several features that the ML2035 does not have. The two main support circuits for the sine wave generator are U2, a 16-input multiplexer, and U3, a 4-bit binary counter. The frequency of the sine wave out of the ML2036 is determined by a 16-bit digital word serially clocked into pin 6, SID (serial input data).

The magnitude of this 16-bit value is determined by the equation: $n(10) = (f_{out} \times 2^{23}) / (f_{CLKin})$. If we use a 3 MHz crystal, this equation becomes: $n(10) =$

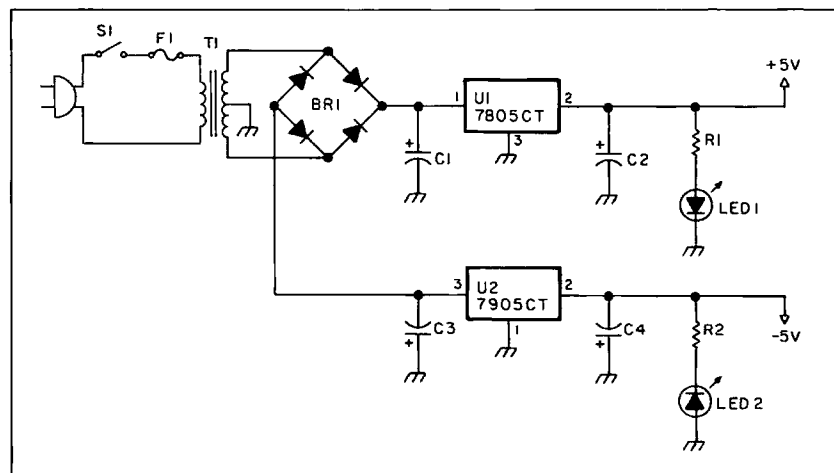


Figure 4. Schematic diagram of the +/- 5 volt power supply.

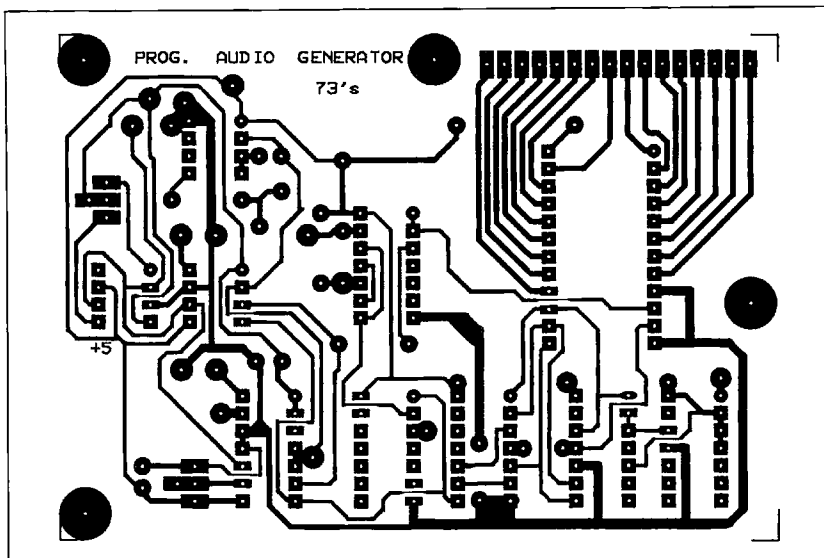


Figure 5. PC board foil pattern for the Audio Generator.

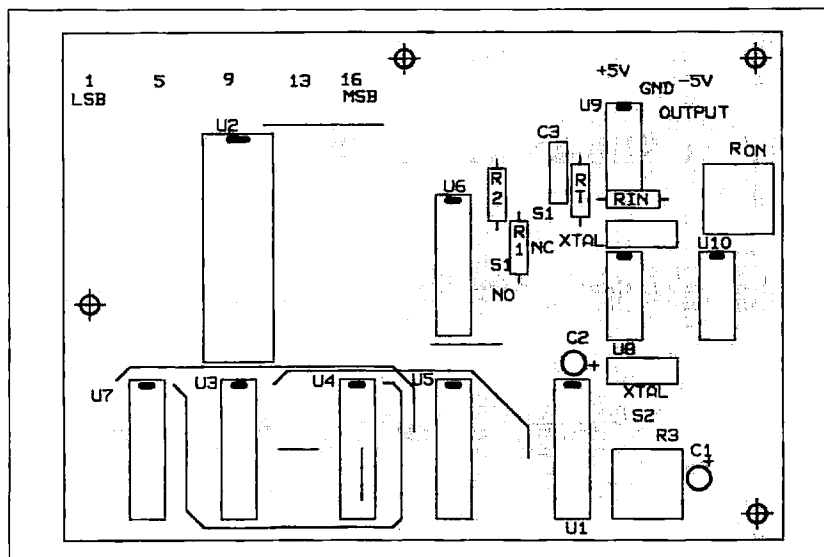


Figure 6. Parts placement for the Audio Generator.

$(8,388,608 \times \text{fout}) / 3,000,000 = 2.7962 \times \text{fout}$. This gives a decimal (base 10) number which must be changed to digital (binary) form. The circuit builder has a variety of methods to apply the digital word to J1 and subsequently to the inputs of the 74150; 16 SPDT switches, 16 DIP switches, or a 16-key keypad encoder. The 74150 can be visualized as a 16-position rotary switch. When started, the 74LS93 counter counts 0000-to-1111, selecting in turn each of the 16 inputs to the multiplexer, LSB (least significant bit) first.

Since the output of the multiplexer is the inverted form of the input bit, we route the inverted bits through one gate of U6, a quad, two-input NAND gate, on to the SID (serial data) input of the ML2036. Each of the 16 bits must be individually clocked into the ML2036 before the 74150 switches to the next bit. Pin 4 of the ML2036 gives us a pulse train at frequency of CLKIN/8. We use

these pulses to clock the counter (on the high-to-low transition). Note that the CLKIN/8 signal is also connected to the pin 5, SCK (serial clock) input. The rising edge of this signal clocks in the bit selected by the multiplexer. After the 74LS93 has counted to 1111, clocking in all the 16 bits, the entire word must be latched by a falling edge applied to pin 7, LATI (serial latch). This falling edge latch signal is derived by feeding the counter outputs to two gates of U4, a 74LS08 quad two-input AND gate. The 74LS08 serves effectively as a four-input AND gate. Until the 74LS93 count reaches 1111, pin 8 of the 74LS08 is low. When pin 8 goes high at count 1111, pin 7 of the ML2036 goes high. This high is also fed to a gate of U5, a 74LS32 quad two-input OR gate. Pin 3 of the 74LS32 goes high, "toggling" U7, a 74LS73 J-K flip-flop. The Q1 output of the 74LS73 is connected to the master reset inputs of the counter, bringing

them high and clearing the counter outputs to 0000. As long as the master reset inputs are high, the counter will not count. With all the counter outputs at 0000, pin 8 of our 74LS08, and subsequently the signal at the LATI input to the ML2036, go low, latching in the 16-bit word. At this latching, the sine wave output appears at pin 10 of the ML2036.

Figure 1 shows our ML2036 with all the bells and whistles attached. S2 provides a logic high or low to pin 13, the GAIN input. When pin 13 is high, the output sine wave peak amplitude is plus or minus VREF. When pin 13 is low, the peak output amplitude is plus or minus VREF/2. R3 provides a variable voltage at pin 9, VREF. If a variable VREF is not desired, we tie pin 9 directly to +5V. Our circuit shows pin 2, PDN-INH (power down-inhibit), tied directly to -5V. [Ed. Note: You can use the +/- 5 volt supply shown in Figure 4 to power the Audio Generator.] In this configuration, when we want the ML2036 to stop generating an output, we simply shift in a 16-bit word of all zeros.

The dashed lines in Figure 1 show the modifications to the circuit when the ML2035 is used. The main difference between the two circuits is that we use a CMOS hex inverter wired as an astable multivibrator to furnish a clock input to the 74LS93 and the serial clock signal to pin 2 of the ML2035.

The circuit builder can't go wrong by including an external buffer at the output of either circuit. The specified output drive capability is a 1k, 100 pF load. I used the ML2036 output directly into the auxiliary input of an audio tape recorder with satisfactory results. I used a 0.5V p-p sine wave, amplitude adjusted with R3. The LM741 operational amplifier makes a suitable output buffer for audio frequencies.

Construction

Construction methods are the circuit builder's choice. I assembled the circuit temporarily on modular breadboard sockets similar to Radio Shack 276-174. I use 22-gauge jumper wires between IC pins. After building the circuit and verifying operation, I then make a permanent assembly on Radio Shack's matching PC board, 276-170. I prefer to use wire-wrap for final connections. Refer to the master wire list and use a continuity checker to verify correct wiring before installing the ICs. Lead dress does not appear to be critical. In the temporary version of the circuit, I used a 12 MHz crystal with untrimmed (1-1/2") leads and connected the CLKOUT pin (6 MHz) to the 74LS93. However, the crystal should be placed physically as close as possible to the CLK in pin. Unless your power supply is on the same PC board as the rest of the circuit, you should bypass the +5V and -5V connections to the ML2036 with 0.1 µF ceramic disc capacitors. [Ed. Note: PC boards are available for the Audio Generator and the +/- 5 volt supply board (see the Parts List for details).]

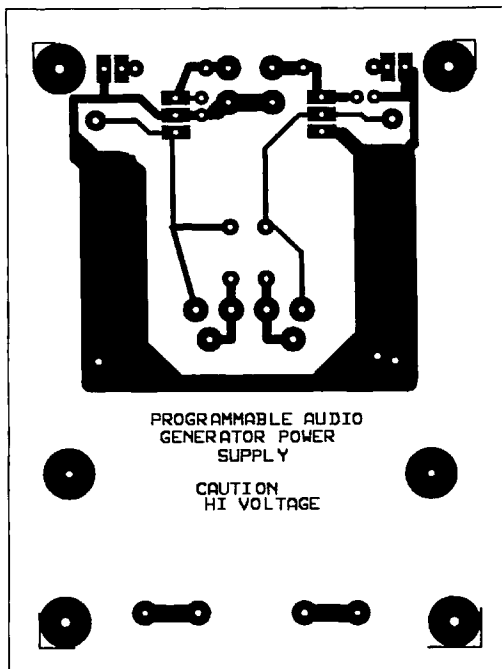


Figure 7. PC board foil pattern for the +/- 5 volt power supply.

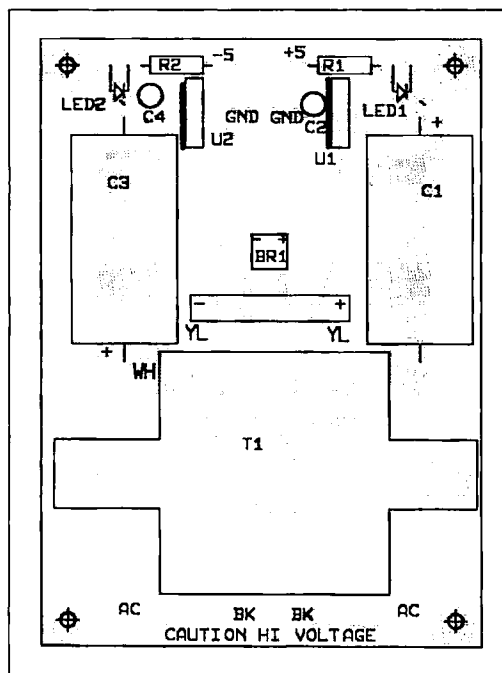


Figure 8. Parts placement for the power supply.

Checkout

The minimum requirement of instruments needed for checkout is a logic probe or DC voltmeter, and some form of a simple audio amplifier. If you want to go first class you can also use a scope and frequency counter.

This checkout procedure applies to the ML2036-based circuit. First, open the short between pin 4 and 5 of the ML2036. Then open the lead between pin 4 of the ML2036 and pin 14 of the 74LS93. Next, connect a

ML2036. Now turn on the power and apply a 16-bit word to the 74150. If you're using an audio amplifier to verify the sine wave generator operation, select a 16-bit word to produce a frequency you can hear.

Depress and release S1 to "toggle" flip-flop U7 and enable the 74LS93. You will observe that all the LEDs are off, indicating a count of 0000 which shows us that switch position 0 (LSB) of the 74150 is selected. Now depress the bounceless push-button

Parts List

Audio Generator

U1	ML2036 programmable sine wave generator
U2	74150 16-input multiplexer
U3	74LS93 4-bit binary ripple counter
U4	74LS08 quad, 2-input AND gate
U5	74LS32 quad, 2-input OR gate
U6	74LS00 quad, 2-input NAND gate
U7	74LS73 dual JK flip-flop
U8	ML2035 programmable sinewave generator
U9	CD4049 hex inverting buffer
Y1	Crystal 3 MHz to 12.4 MHz (see text)
R1,R2	2.2k, 1/4 W, 5%
R3	10k potentiometer
RT	(see text)
Rin	(see text)
C1,C2	0.1 μ F ceramic-disc capacitor
C3	(see freq. equation for U9)
S1	SPDT momentary switch
S2	SPDT switch
PC board	See Note 2
Misc:	Perfboard materials, IC sockets, wire, solder, enclosure, hardware, etc.

Power supply parts list.

S1	SPST switch, 6A @ 125V	RS# 275-634
F1	Fuse, fast acting, 500 mA	RS# 270-1271
T1	Power transformer, 12.6 VCT, 450 mA	RS# 273-1365
BR1	Bridge rectifier 1A @ 50 PIV	RS# 276-1161 or 276-1146
U1	7805CT, +5V voltage regulator	RS# 276-1770
U2	7905CT, -5V voltage regulator	(See Note 1)
C1,C3	2200 μ F/35V electrolytic capacitor	RS#272-1020
C2	0.1 μ F/35V tantalum capacitor	RS# 272-1432
C4	1.0 μ F/35V tantalum capacitor	RS# 272-1434
R1,R2	330 ohm carbon film resistors, 1/4W, 5%	RS# 271-1315
LED1,LED2	Light emitting diodes	RS#276-041
PC board	See Note 1	

Note 1: The 7905 type -5 volt regulator is not normally stocked by Radio Shack but can be special ordered from them. It's also generally stocked by most mail order houses.

Note 2: Etched and drilled PC boards are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118. The Audio Generator board is \$6 and the +/- 5 volt power supply board is \$5. Please add \$1.50 per order for postage.

Note 3: Micro Linear spec sheets and a distributor list are available from Micro Linear, 2092 Concourse Drive, San Jose CA 95131. Phone: (408) 433-5200. Three of the distributors are:

Tempe Insight Electronics, Inc.	Interface Electronics Corp.	Pioneer Technology
1515 W. University Drive, Suite 103	228 South Street	9100 Gaither Road
Tempe AZ 85281	Hopkinton MA 01748	Gaithersburg MD 20877
(800) 677-7716	(800) 632-7792	(800) 227-1693

330 ohm current limiting resistor and a LED to each of the four 74LS93 outputs Q0-Q3. The anode of each LED is connected to the resistor and the cathode is connected to ground.

Fabricate a bounceless push-button switch similar to S1 in our complete circuit. Connect the momentary switch and resistors so the output goes low-to-high when the switch is depressed. Connect the output of this switch to pin 14 of the 74LS93 and pin 5 of the

you have connected to pin 14 of the 74LS93. The low-to-high transition of the output will clock in the LSB of our 16-bit word. When you release the bounceless push-button, the high-to-low transition of the output will clock the 74LS93 and the LEDs will indicate a count of 0001. Continue operating the switch until you observe the LEDs indicate a count of 1111. Depressing the push-button one more time will clock in the MSB (most significant bit) and releasing it will cause the 74LS93 count to show 0000, bringing the reset inputs high and latching in the 16-bit word. The ML2036 should now be generating the desired frequency.

After you have verified proper operation of the circuit, disconnect the LEDs and current-limiting resistors. Disconnect your temporary push-button switch and replace the short between pins 4 and 5 of the ML2036. Finally, replace the connection between pin 4 of the ML2036 and pin 14 of U3. Your circuit is now ready to be used as an audio frequency test generator.

See Table 1 on page 30

The SP-1 Transceiver

Build the HF "Spider."

by Mike Agsten WA8TXT

The idea of bringing ham radio along on a wilderness jaunt has strong initial appeal, but when the details are itemized it becomes apparent that sheer weight and volume will displace the truly essential needs like drinking water, food, and raiment.

Let's see . . . I'll take the back-up transceiver, deep-cycle trolling battery, wattmeter, antenna tuner, memory keyer, headphones, wire, coax cable . . . wait a minute! Is this Field Day, or a camping trip?

While I don't mind exposing myself to the great outdoors, even the back-up transceiver has considerable monetary value (and weighs a ton!). No; what I need is a rough-and-ready rig. Something so inexpensive that it could almost be considered a "throwaway."

The "Spider" Solution

The SP-1 Spider is designed to fit this bill. I've nicknamed it after our friend the arachnid because, in ordinary operation, you plug in a crystal and wait, patiently if necessary, for your next victim to arrive on frequency! For wilderness skeds, the gang back home is well accustomed to digging weak signals from the noise, but in case they've exaggerated their radio prowess, I've allowed one full watt of transmitter power: perfect for a battery of "AA" cells. At home they can adjust power as needed, so the SP-1 receiver section is nothing special: a direct-conversion mixer and IC audio amplifier. Provision for an audio bandpass filter is included.

A well-designed VFO may be drift-free at home, but in the ever-changing outdoors, crystals are far more predictable, especially in this category of simple equipment. As presented, the Spider holds two switch-selectable FT-243 type crystals, though other arrangements are possible. A single HC-18 wire-lead crystal, for example, can be installed directly on the PC board, or a rotary-switched bank of them might replace the octal socket used here.

It's a bit preposterous to carry accessories bigger than the rig itself, so I've included a built-in telegraph key and, instead of visual output indication, a "smart-tone." This circuit monitors RF output and varies the sending sidetone pitch accordingly. You can be sure you're on the air if you hear "good tone" when you close the key, so leave the wattmeter at home!

Portable operation isn't the only possibility for this rig. It should work even better with the well-deployed sky hooks in your back yard. And if you find a prospective Novice interested in telegraphy, it might make a great loaner. Disable the transmitter and you've got, essentially, a code practice set with a built-in receiver.

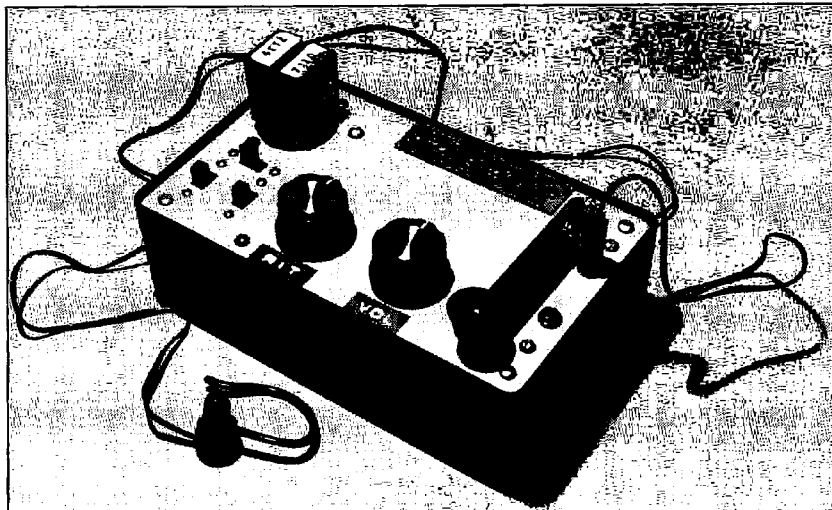


Photo A. The SP-1 portable CW transceiver.

Circuit Description

If you judge a circuit's simplicity by transistor count alone, the SP-1 may appear more complex than necessary to fill the needs listed here. But, most generic transistors cost little more than capacitors so I tend to use them with impunity wherever the need to "transfer resistance" occurs, and let the chips fall where they may. Q3 (see Figure 1) is one example of this approach. It's not essential but it does allow you to operate oscillator Q1 at reduced current drain during receive (a battery-saving feature) without sacrificing drive to final amplifier Q2 on transmit. During receive, Q4 prevents the emitter-base junction of Q2 from otherwise clipping the oscillator waveform, which may lead to undesired receiver responses. It also provides a handy place for leading-edge envelope shaping with R9, R10 and C8.

During receive, incoming signals pass through L3, L2, C15 and C19 to receiver-tuned circuit T2/C25 and gate 1 of mixer Q7. With the oscillator signal via C18 present at gate 2, Q7 produces the desired audio beat note which proceeds through volume control R31 to audio amplifier U1. This LM386 IC provides enough power gain to drive a small loudspeaker at home, or ear buds or headphones in the field. Should you desire an audio bandpass filter, insert it in place of wire jumper W3. Receiver fine-tuning is accomplished by varying the tuning voltage on D1 with R1T control R32.

Automatic T/R switching (QSK) begins at key closure. Q8 switches on, rapidly energizing the 12T bus. 12T, the master control signal in this rig, switches many circuits. Let's take a

look at each, in case you need to troubleshoot. D4, via R11, turns on to protect the receiver input. Q5 turns on and, by grounding D1 tuning voltage, frequency shifts oscillator Q1 down about 1 kHz, the actual amount depending on band and L1 inductance.

Q6 mutes the receiver audio while sidetone from Q9 and level adjustment R22 takes over the audio channel. Q4 turns on and keys RF power amplifier Q2. Transmitter RF is routed through low-pass filter L2/L3 to the antenna terminal, and via C16 to RF detector D3. The output level detected by D3 controls Q10 conduction which, in turn, varies the program voltage to Q9, with a programmable unijunction transistor used here to generate sidetone. Full RF output cuts off Q10, raising Q9's program voltage and lowering its output frequency to the normal pitch. This "smart-tone" action is far from linear but still very useful. A dying battery, for instance, will produce a rising sidetone pitch when the key is held down (time to revert to smoke signals or a message in a bottle!). Upon key release, C27 shapes the trailing edge and Q6 with C20 covers up the receive-recovery pop.

Construction

In the top view photograph of the Spider, you can see the octal crystal socket in the left-rear corner. Crystal select switch S2 is just in front. TB1, a four-lug terminal board, mounts along the rear of the top panel. Its terminals are numbered 1 to 4, going from left to right. Connections are DC power to 1 (+) and 2 (-) and antenna system to 3 (ground) and 4 (hot). Along the right edge are 3.5 mm jacks for

speaker/phones (J2-rear) and an external telegraph key (J1-front).

The built-in telegraph key is just left of the jacks. The key arm, a strip of 0.032" brass or aluminum, is mounted on 1/4" spacers and grounded to the top panel by its two mounting

screws. The key knob, a cannibalized equipment foot, is fitted or glued to a hex nut (or two) attached with a machine screw through the arm. The key contact beneath the arm is a 6-32 brass machine screw with the head filed flat. This screw is insulated from the top panel

with a shoulder washer above and a fiber washer below.

The two knobs front and center on the top panel are volume control R31 on the right and receiver incremental tuning (RIT) R32 on the left. Just left of RIT is slide switch S3, unused

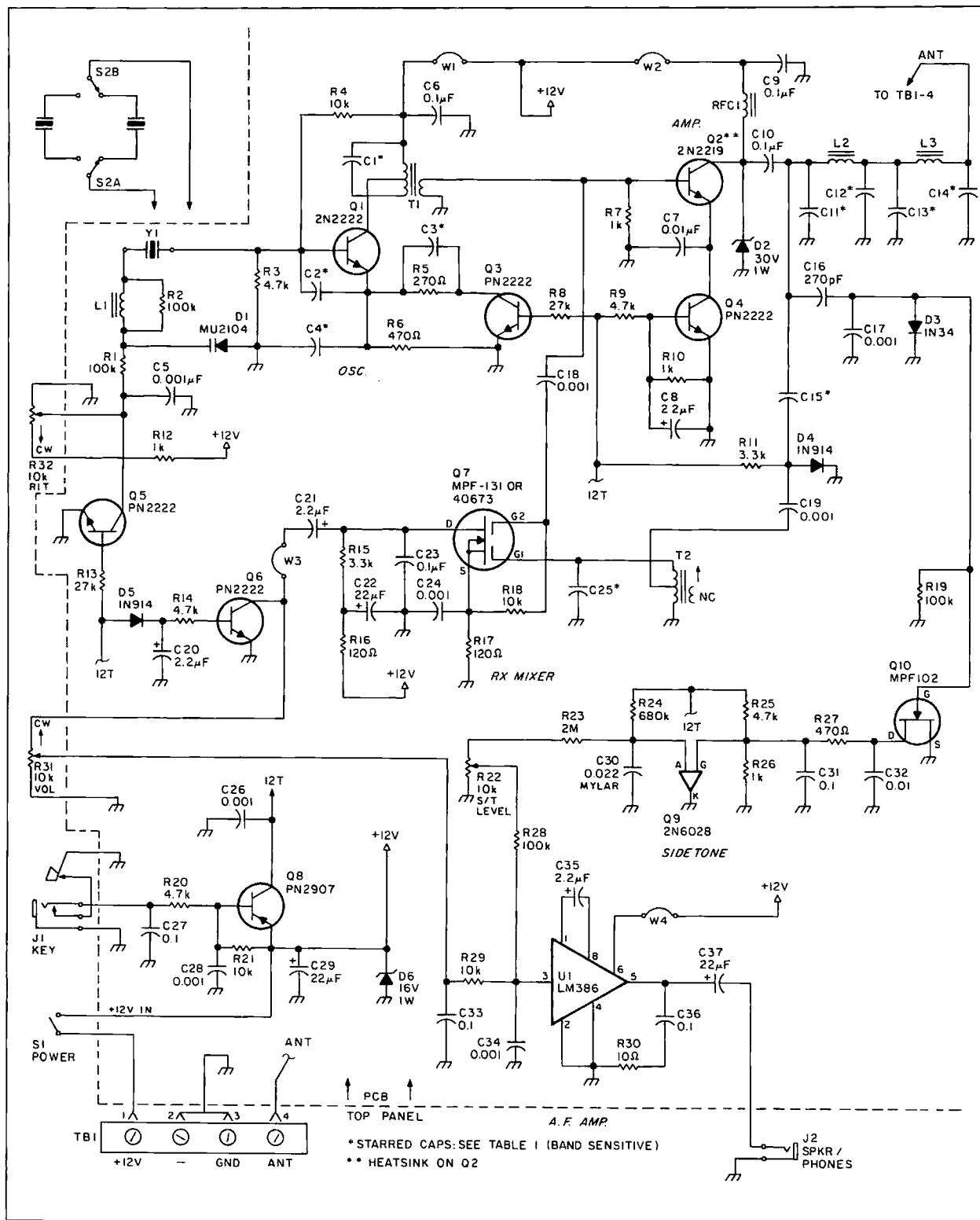


Figure 1. Schematic diagram of the SP-1 transceiver.

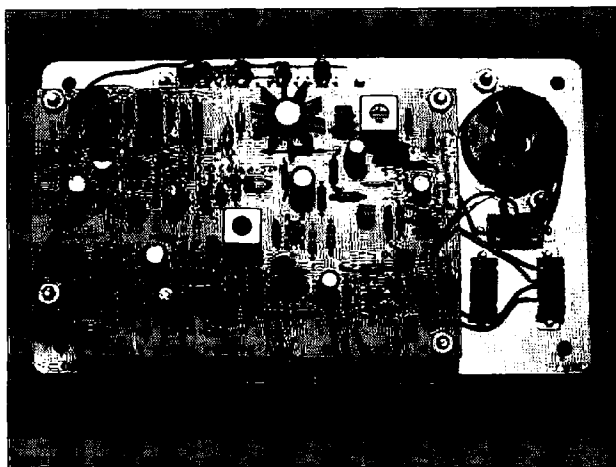


Photo B. Inside view of the SP-1. The PC board, switches and sockets are mounted directly to the bottom side of the project box metal cover.

Table 1. Band Data

	80-M	40-M	30-M
C1	390 pF	68 pF	Not used
C2	18 pF	Not used	Not used
C3	680 pF	Not used	Not used
C4	820 pF	680 pF	390 pF
C11	390 pF	100 pF	Not used
C12	820 pF	820 pF	270 pF
C13	680 pF	Not used	270 pF
C14	680 pF	390 pF	270 pF
C15	39 pF	27 pF	18 pF
C25	390 pF	68 pF	Not used
L1 (FT37-61)	40T #30	23T #28	17T #28
L2-L3 (T50-2)	19T #24	14T #24	12T #24

Capacitors are ceramic disk type. C15 may be a trimmer capacitor spanning the range shown above (Mouser 24AA024, 9-50 pF).

For inductors, wind turns using the enamel wire gauge given on the toroid core type specified.

here but intended for future audio filter switching or other contingencies. Left of S3, in the left-front corner, is DC power control switch S1.

Nearly all parts reside on the PC board depicted by the etching pattern shown in Figure 2 and the parts overlay, Figure 3. Band-sensitive part values are listed in Table 1. PC boards and project kits for the Spider are available (see the Parts List). The finished PC board is first wired to all the top panel parts except the antenna and ground lugs of TB1 (lugs 4 and 3 respectively) and the common terminals of crystal select switch S2. The board is then hinged over, to be suspended below the top panel (parts down) on 5/8-inch metal spacers. Now the short RF connections to TB1 and S2 can be made.

Overall, this packaging method is economical and makes servicing a snap. Metal work is confined to just one flat panel. Except for TB1 and the key contact, all the innards can be removed intact should you desire to paint and letter the top panel. The case is a Radio Shack No. 270-627 measuring 6.25" x 3.75" x 2" and the finished weight of the SP-1, with two crystals plugged in, is 11 ounces.

I'd be remiss if I failed to mention a lucky coincidence. The entire Spider will nestle into a plastic card file box, with ample room below for the battery pack. Post sked details and secure "ear buds" fit inside the top cover for the ultimate find-in-the-dark convenience. Close the lid and crystals and operating controls are no longer exposed and vulnerable to the rigors of your march. The card file box is a Sterling Plastics No. 529. I use them for QSL storage and see them in the office supply section of stores everywhere. Now at least the radio will survive.

Tune-Up

Connect 12-14 VDC and wattmeter with dummy load to TB1 as described earlier. I recommend a lower than normal (0.5 amp) in-line fuse at first, to minimize damage in case of a major wiring error or soldering mistake. Switch on and close the key. You should hear high-pitched sidetone in the speaker or phones. Install a crystal for the band of choice and increase the fuse rating to 1 or 2 amps (if it hasn't blown!). Close the key and adjust T1 for

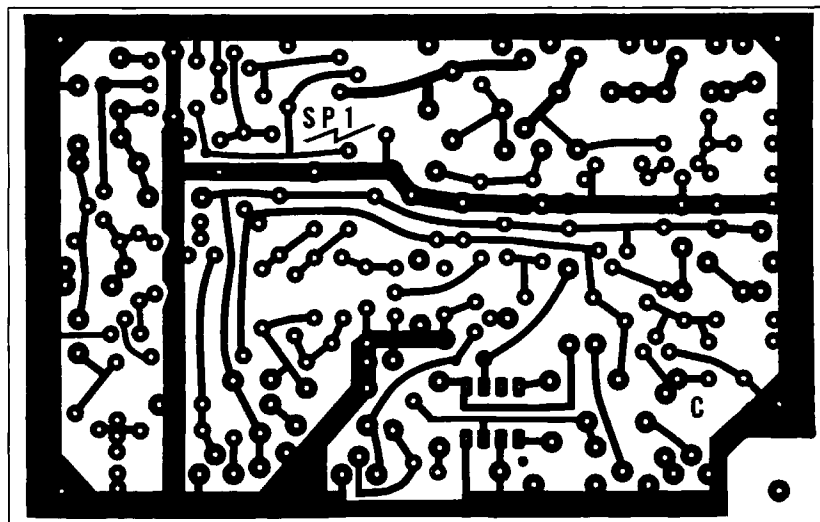


Figure 2. PC board foil pattern.

Parts List

C11-C4,	(See Table 1)
C11-C15, C25	(See Table 1)
C30	0.022 μ F Mylar(TM) (RS 272-1066)
D1	MV2104, ECG612, 1S2687
D2	30V, 1W zener diode (1N4751)
D3	1N34, RS 276-1123
D4-D5	1N914 or 1N4148
D6	16V, 1W zener diode (1N4745)
J1-J2	3.5 mm closed-circuit mini phone jack
L1-L3	(see Table 1)
Q1	2N2222, ECG123A
Q2	2N2219, ECG128, RS 276-2030
Q3-Q6	PN2222, ECG123AP, RS276-2009
Q7	MPF-131, ECG222, 40673
Q8	PN2907, ECG159
Q9	2N6028, ECG6402 (P.U.T.)
Q10	MPF102, ECG312, RS 276-2062
R31-R32	10K audio taper potentiometer, RS 271-1721
RFC1	22-33 μ H epoxy-coated (Mouser 43LS275) or 22 turns #28 enameled on FT37-61 core
T1-T2	Mouser 42IF123
U1	LM386, ECG823, RS 276-1731
Y1	Fundamental, FT-243 holder, 32 pF load. Order 1 kHz above desired transmitting frequency.

Note: PC boards and project kits for the SP-1 "Spider" are available from Lectrokit, 401W. Bogart Rd., Sandusky OH 44870 (no telephone). SP-1BBM, \$12, includes bare PC board and step-by-step construction manual. SP-1PCK, \$29, includes SP-1BBM plus all PC board parts, including those necessary for 80, 40 and 30 meter operation. SP-1KIT, \$39, is the complete kit containing all the above plus case and case parts, but not operating crystals. Include \$4 shipping and handling for SP-1PCK and SP-1KIT orders; the SP-1BBM is postpaid, USA. Ohio residents please add appropriate sales tax. Order direct or send an SASE for current details. This pricing is valid within six months of publication.

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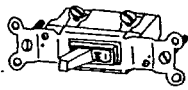
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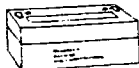
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The SP-1 Transceiver

Continued from page 29

minimize it at the expense of some "in-band" sensitivity.

On the Air

With the Spider's rather broad selectivity, it may not be obvious if the signals heard are close enough to your frequency for a QSO. Those that approach zero-beat with the RIT control fully counterclockwise are very close. Others may be workable if the operator tunes around for your signal.

In addition to maintaining short-haul skeds from the field (see the sidebar), I had anticipated months of fun trying to extend Spider DX on all three bands from my home QTH. But

right off the bat, 40 meters produced KBØIZC in Kansas, followed by a couple of West Coast stations. Maybe 80 would be less fruitful . . . no. With the rig still clip-led together on the bench, VE7WIN in Coquitlam, B.C., fell right into my lap (er, web!). Further down the log, I see (and well recall) a 559 report on 30 meters from VK2VA in Sydney, Australia. In all cases, the antenna used was my old reliable, a 45- by 70-foot inverted L. So, this rig is indeed adequate, despite its simplicity and low cost. But the results are, more often than not, a tribute to the forgiving nature of HF radiotelegraphy and, occasionally, bull-dog tenacity at the other end. Good luck with the SP-1 Spider!

My thanks to Jim NZ8B, who suggested "smart-tone" and assisted with SP-1 field trials.

Programmable-Frequency Audio Generator

Continued from page 16

U1 ML2036				U4 74LS08			
From Pin	To IC	Pin					
1	-5V		3	4	10		
	C2		6	4	9		
2	-5V		7	GND			
3	NC		8	5	1		
4	1	5	14	+5V			
	3	14					
6	6	3		2	6	8	
7	4	8			6	12	
	5	1		3	7	1	
8	+5V			7	GND		
	C1		14	+5V			
	R3						
9	R3						
10	LM741	2	7	GND			
11	GND		9	6	11		
12	GND		10	R1			
13	S2	Common		N.O. Terminal, S1			
14	Y1		13	R2			
				N.C. Terminal, S1			
			14	+5V			
U2 74150				U7 74LS73			
1	J1	8					
2	J1	7					
3	J1	6	2	+5V			
4	J1	5	3	+5V			
5	J1	4	4	+5V			
6	J1	3	11	GND			
7	J1	2	14	+5V			
8	J1	1					
9	GND						
10	6	1	1	-5V			
	6	2	2	3	14		
11	3	11		9	2		
	4	4	3	6	3		
12	GND		4	4	8		
13	3	8	5	+5V			
	4	5	6	LM741	2		
14	3	9	7	GND			
	4	2	8	Crystal			
15	3	12					
	4	1					
16	J1	16	1	+5V			
17	J1	15	2	C3			
18	J1	14	3	9			
19	J1	13		RT			
20	J1	12	5	RIN			
21	J1	11	8	GND			
22	J1	10					
23	J1	9					
24	+5V		2	LM741	6		
U3 74LS93				U10 LM 741			
1	3	12	3	GND			
2	3	3	4	-5V			
	7	12	6	Input of audio circuit under test			
5	+5V		7	+5V			
10	GND						

Table 1. Programmable-frequency audio generator master wire list (for wire-wrapping purposes).

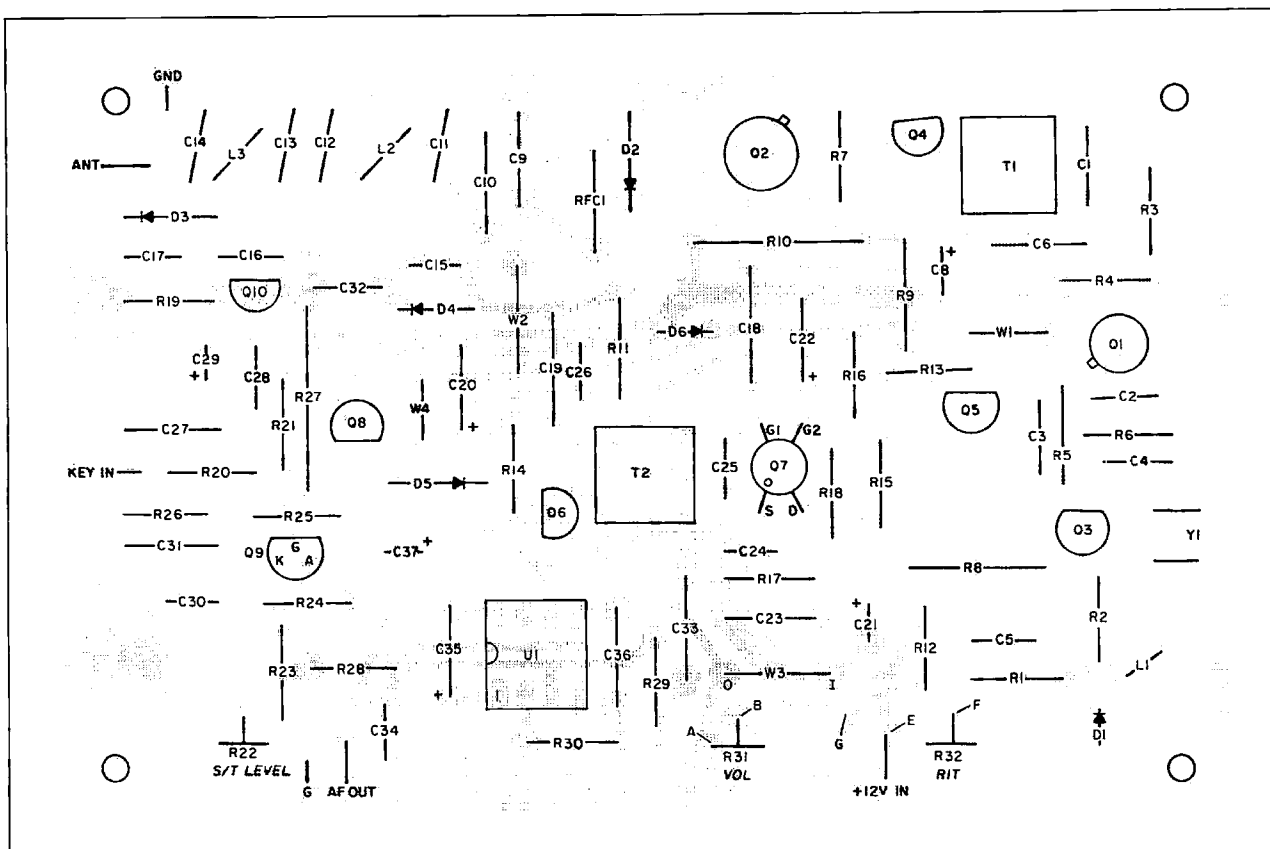


Figure 3. PC board parts placement. To disable the transmitter, remove wire jumper W2. Also remove R27 to lower sidetone pitch to normal with transmitter disabled.

Spider in the Field

Sure, the Spider's cute, but is it really practical? We decided to test it in a worst-case scenario on 80 meters. My brother Jim NZ8B grabbed some camping gear, the 80M SP-1 prototype, 65 feet of wire and a 12-volt lantern battery and headed for the hills near Athens, Ohio, about 175 miles distant. Just prior to his departure, we did a quick dial calibration check noting the precise transmission frequency of his main and back-up crystals.

We chose 7:30 p.m. for our nightly schedule time, hoping to catch the window between D-layer breakup and QRN/QRM build-up. With two exceptions, this schedule was maintained for the next 16 days as Jim moved around sampling the camping and hiking fare at various locations. One sked was missed due to freezing temperatures (no antenna at the motel refuge) and another because of a thunderstorm on my end. Otherwise, Spider signals ranged from RST 339 to 569. This was good enough for our brief exchanges but not always armchair copy. With 100 watts going his way, I had no trouble breaking him (QSK) for fills or to mark time during a deep fade. Jim also carried a 3581 kHz crystal for W1AW bulletin reception and reported an "uncanny feeling" hearing the grand old station by campfire light in the midst of a dark forest!

Upon his return, we duplicated the typical field installation to take some measurements. The antenna was a quarter-wave "lazy inverted L" which rose 25 feet up from the rig, bent around a tree

limb, and then sloped gradually downward to a height of about seven feet. The ground system was an eight-inch tent stake (we said this was a worst-case scenario). SWR measured 4:1. No doubt confirming the high ground resistance and implying rather low radiation efficiency. Nevertheless, it worked.

We experimented with simple earth grounds and concluded that, for a Marconi antenna like this, three eighth-wave radials (33 feet long) far surpass the tent stake. SWR fell to 1.4:1 and relative field strength increased noticeably. On 40 or 30 meters (and 80 if you can), a simple half-wave dipole strung "inverted V" fashion would be hard to beat.

The 12-volt lantern battery, it turned out, was actually delivering only 11.2 VDC (key down) to the Spider, resulting in just 800 mW of RF output. A better choice would be nine or 10 carbon-zinc cells or 12 NiCds, "AA" size or bigger in either case. This way, the greatest portion of the battery discharge curve will be above 12 volts rather than below.

The "earbuds" used for listening had too much high-frequency response, resulting in unwanted background hiss even with the volume turned down. A pair of inexpensive mono earplugs Y'd together might do a better job in this application. All in all, the field trial was a success. We kept in touch, and afterward learned how to pick up an easy S-unit by optimizing the battery and earth ground.

maximum power output. The sidetone pitch should be distinctly lower if the smart-tone is working. Connect an antenna and adjust T2 for best receive when you hear a signal. That's it.

I experienced no difficulty with AM detec-

tion on 80 and 40, even though this receiver type is known to be prone. On 30 meters in the evening, a couple of North American broadcasters in the 31 meter band became intermittently audible, but code signals in the ham

band remained readable. Most other times 30 meters is clear. If you have a problem with AM detection, reduce the value of C15 to

Continued on page 30

Twin Crystal Ladder Filters

Upper or lower sideband filters using inexpensive crystals.

by John Pivnichny N2DCH

Crystal ladder filters are a good way to provide the selectivity required in single sideband transceiver equipment. Pochet¹, Hardcastle², and Hayward³ have described the basic approaches for these filters. Their unique characteristic is that all crystals used in a filter are of the same (identical) frequency. This allows you to make use of the low-cost "microprocessor" and "colorburst" crystals now available in a variety of specific frequencies. With these filters, it's no longer necessary to specially order and pay lots of money for specifically cut crystal frequencies.

In this article I describe two filters designed for lower sideband and upper sideband service using a common carrier frequency. Both filters are constructed from 9830.4 kHz microprocessor crystals available from DigiKey (Digi-Key Corporation, Catalog #925, page 110, part number X087, 9.8304 MHz crystal, 20 pF load capacitance).

A transmitter carrier frequency, or BFO in a receiver application, can be supplied by a single oscillator operating at approximately 9829.5 kHz and using another 9830.4 kHz crystal. A suggested circuit for this oscillator is given.

The filters are shaped to provide either upper or lower sideband operation with excellent suppression of the unwanted sideband. I suggest that you incorporate both filters in transceiver designs. In some applications, such as simultaneous transmission/reception of slow-scan video on one sideband and voice on the other, both filters could be in operation at one time. This simultaneous use of both sidebands is also referred to as "independent sideband," ISB⁴.

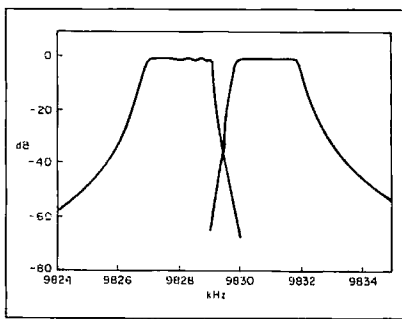


Figure 1. Calculated filter passbands.

Filter Circuits

Figure 1 shows calculated filter passbands; Figure 2 shows corresponding schematics for the two filter circuit diagrams. Note that the same terminating resistance is used for either filter. This is only possible through the unconventional use of an inductor at both ends of the lower sideband filter. The capacitor values for both filters were carefully selected to provide passbands which are mirror images reflected about the carrier frequency. The passbands are 35 dB down at the carrier and provide suppression of the unwanted sideband well in excess of 80 dB. Ultimate rejection of the other skirt is over 60 dB. These are very good figures for relatively simple home-built filters. They are easily duplicated with ordinary construction practices, as described below.

Crystal Measurements

The crystals are specified by Digi-Key as ± 50 parts per million at 25 degrees Celsius, with another ± 100 ppm from zero to 70 degrees C. Aging is another 10 ppm per year. This works out to be ± 492 hertz initial tolerance. I found the series resonant frequencies to be much better matched.

Using the 50-ohm test circuit shown in Figure 3, I measured a batch of 20 crystals and got the results shown in Table 1. The average series resonant frequency of the first eight measurements was 9,825,945 Hz with just over 100 Hz, plus or minus deviation. The average series resistance was 33 ohms ± 4 ohms. Motional capacitance is 0.02438 pF and motional inductance 10.76 mH. These were measured using Hayward's tech-

nique and formulas. The holder capacitance appears to be about 7 pF.

Measurements on crystals 9 to 20 also averaged 9,825,945 Hz (wow) with slightly over 250 Hz plus or minus worst case deviation. With such excellent matching, it is safe to recommend selecting crystals at random and just soldering them in to build the filters. It's not necessary to take crystal measurements first.

Of course, if you were thinking of building a CW bandwidth filter, then I would match the crystals to under 100 Hz, but with these SSB bandwidths, that just doesn't seem necessary. Duplicating these filters is much easier if you don't have to measure each crystal.

Note that the calculated passbands shown in Figure 1 were based on the measured capacitance and inductance values for the crystals given above. If you want to reproduce these calculations and have them come out exactly on frequency, then use a more accurate value of the motional inductance of 10.76113 mH.

Inductors

As originally designed, the lower sideband filter had a series capacitor of 118 pF at each end. The termination resistance was 201 ohms. I wanted to "step" this up to 2,831 ohms to match the impedance of the upper sideband filter. A step up is only possible if you add a series inductor and shunt end capacitor. In essence, the inductor cancels out some of the high reactance of the shunt end capacitor and makes it look like a higher value (lower reactance) series capacitor. You could also step up the impedance with a transformer using a ferrite toroid core.

The inductor value is not particularly critical because it is not resonant with anything in the neighborhood of 9.830 MHz. It is merely used for impedance transformation and normal tolerances are OK. Fifty-five turns of #30 gage copper wire on a T37-6 (yellow) toroid core gives the right value of

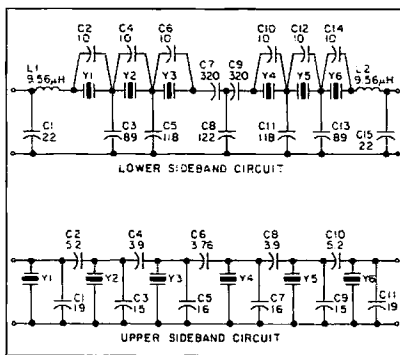


Figure 2. Filter schematics. All capacitors in pF.

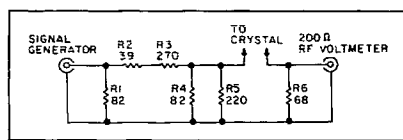


Figure 3. 50-ohm test circuit.

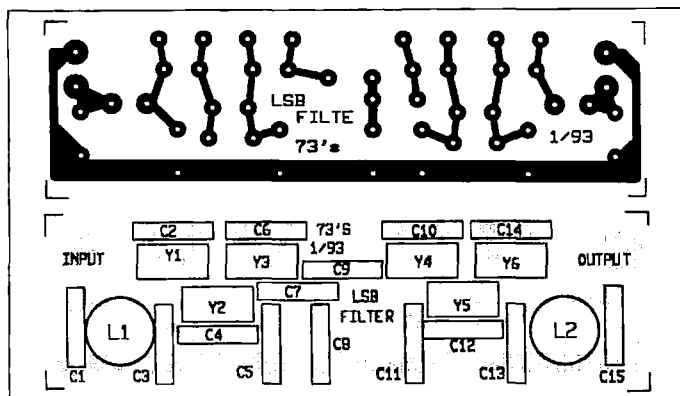


Figure 4 (a). PC board foil pattern for the lower sideband filter. (b). Parts placement diagram.

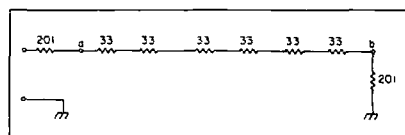


Figure 6. Circuit for estimating insertion loss of the lower sideband filter.

inductance, with a Q of about 160. You can check the value quickly by temporarily soldering a 100 pF capacitor across the ends of the wound toroid. Leave enough lead length to form a one-inch-diameter loop. Then check the resonant frequency with a dip meter placed near the loop. It should read about 5.15 to 5.17 MHz. If it's way off, add or remove a turn or two.

Capacitors

Like the inductors, the capacitor values are also not particularly critical. I used small 50-volt ceramic capacitors from NTE (tolerance unknown). If you want to be a purist about it, go with silver miccas, but I don't think that's necessary in a home-built filter.

Construction

I use one-ounce, single-sided epoxy glass circuit board cut into a 3/4-inch strip with a coping saw. With the foil side up, I mark component hole locations by eye with a sharp-pointed metal scribe. Then I drill the marked points using a #60 drill bit (0.040-inch diameter) in a hand drill. Points which connect to the ground plane are left as is, and all other holes are countersunk with a 0.12-inch diameter bit. About five turns of the hand crank of the drill is enough at each hole. This leaves a nice insulated through-hole position. The remaining epoxy glass holds the component lead centered in the countersunk hole.

A 2-1/2-inch length of circuit board was enough for my upper sideband filter. This may vary somewhat depending on the size of your capacitors, but mine required three inches for the lower sideband filter in order to fit in the inductors. I fastened down the inductors with a 4-40 nylon machine screw and nylon nut after first placing one layer of black tape on the foil under the inductor.

Components are then inserted and sol-

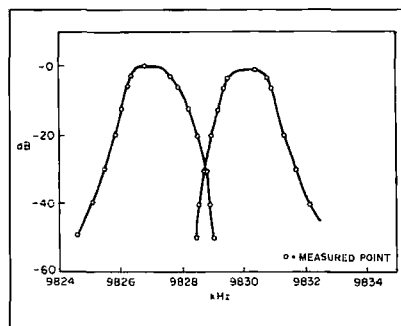


Figure 7. Measured passbands.

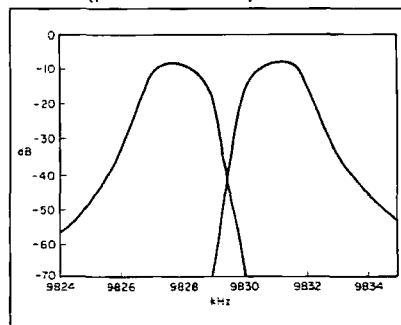


Figure 8. Calculated passbands with series resistance included.

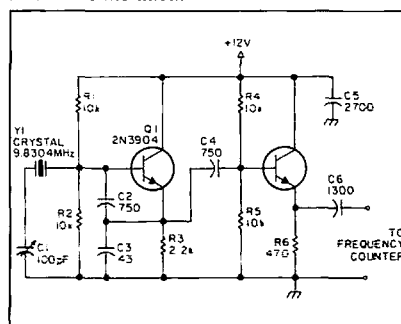


Figure 9. Oscillator circuit for use as a BFO or transmitter carrier.

dered together on the back side. Ground connections are made on the front side as needed. This drilling technique makes an excellent filter. If you're going to build many copies of the filters, then an etched circuit board might be in order, but for just one or two, the drilling approach is faster and pro-

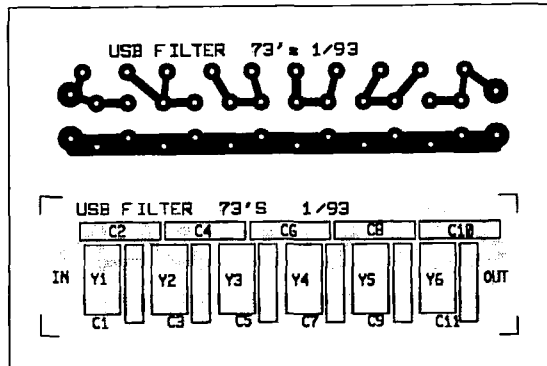


Figure 5. (a). PC board foil pattern for the upper sideband filter. (b). Parts placement diagram.

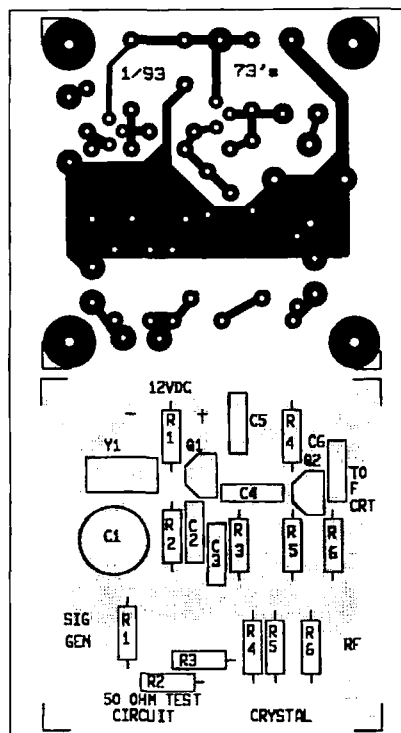


Figure 10. (a). PC board foil pattern for the oscillator circuit. (b). Parts placement. Note that the 50-ohm test circuit shown in Figure 3 is incorporated on this board.

vides a solid ground plane for shielding.

[Ed. Note: Etched and drilled PC boards are available for the two filters as well as the oscillator test circuit from FAR Circuits. The foil patterns and parts placement for these boards are shown in Figures 4 and 5.]

Final Check

How do the actual filters compare to the calculated responses? Well, the high series resistance (33-ohm) of these microprocessor crystals creates an insertion loss and distorts the pattern somewhat. One way to estimate this loss for the lower sideband filter is to temporarily ignore the reactive elements, the capacitors and inductors, and just look at the resistances (see Figure 6). Use the original termination, before stepup, of 201 ohms. Note—the impedance stepup does not

change the insertion loss.

The crystal series resistors create a resistive voltage divider circuit between the filter input and the final terminator, points a and b in Figure 6. The loss is:

$$\text{Loss} = \frac{198}{201 + 198} = 0.496 = -0.9 \text{ dB}$$

I haven't found any easy way to estimate the insertion loss of the upper sideband filter. It turns out to be about the same, however, preserving the symmetry of the two filters.

My actual measurements of the filter passbands are shown in Figure 7. These are only approximate because of the limitations of my simple home-brew instrumentation. Note the more rounded passbands but still very steep skirts. Reasonable symmetry and spacing between the two filters demonstrates their usefulness for upper and lower sideband service. If the series resistance is included in the calculated frequency sweeps (it was neglected in Figure 1) then the same rounded off tops and insertion loss show up—see Figure 8. In fact, there is good agreement between the calculated and measured results.

An Oscillator

The carrier oscillator in a transmitter or BFO in a receiver should be placed at the frequency where the two passbands cross. This point is between the series resonant frequency of the crystal and the specified 20 pF load parallel resonant frequency of 9,830,400 Hz. So an oscillator circuit can be built using another crystal of the same frequency as those used in the filter. The load capacitance will have to be slightly higher than 20 pF in order to "pull" the oscillator frequency down a little.

Using the oscillator circuit shown in Figure 9, which I had already built up for an earlier project, I found the frequency could be pulled from 9,833,393 Hz down to 9,828,485 Hz by adjusting the 100 pF trimmer capacitor from a minimum of about 10 pF to its maximum of 100 pF. This is more than enough range to properly place the carrier frequency. The measured passbands cross at 9,828,700 Hz. The oscil-

lator PC board foil pattern and parts placement are shown in Figure 10.

Conclusions

Ladder crystal filters are ideal circuits to use in constructing homemade hardware because specially-cut frequencies are not needed. Low cost microprocessor crystals can be used to construct very satisfactory filters. This article shows that both upper and lower sideband filters can be made using a single crystal frequency, greatly enhancing their potential for use in multiband transceivers. They can also be used for independent sideband, ISB, service.

It appears that satisfactory filters can be built simply by purchasing low cost parts and "hooking them up." No special equipment or tuning or experience is required. So if you like to build your own ham radio gear, why not give these filters a try?

References

- 1) J. Pochet F6BQP "Essais, Mesures et Realisation de Filtrés a Quartz." Radio REF, May 1976, pages 388-391, in French.
- 2) J. Hardcastle G3JIR, "Some Experiments with High Frequency Ladder Crystal Filters," Radio Communication, December 1976, pages 896-905, also in QST, December 1978, pages 22-24.
- 3) W. Hayward W7ZOI, "A Unified Approach to the Design of Crystal Ladder Filters," QST, May 1982, pages 21-27.
- 4) J. A. Dyer G4OBU, "HF Receiver Design," Communication Quarterly, Volume 2, No. 3, Summer 1992, pages 81-97.

Parts List.

Lower Sideband Filter	
Y1—Y6	9.8304 MHz crystal, Digi-Key# X087
L1, L2	9.56 µH, 30 turns on a T37-6 toroid core
C1, C15	22 pF
C2, C4, C6	
C10, C12, C14	10 pF
C3, C13	89 pF
C5, C11	118 pF
C7, C9	320 pF
C8	122 pF
Upper Sideband Filter	
Y1—Y6	9.8304 MHz crystal, Digi-Key# X087
C1, C11	19 pF
C2, C10	5.2 pF
C3, C9	15 pF
C4, C8	3.9 pF
C5, C7	16 pF
C6	3.76 pF
Oscillator Circuit	
Y1	9.8304 MHz crystal, Digi-Key# X087
R1, R2, R4, R5	10k resistor
R3	2.2k
R6	470 ohm
C1	100 pF trimmer
C2, C4	750 pF
C3	43 pF
C5	2700 pF
C6	1300 pF
50-ohm Test Circuit	
R1, R4	82 ohm
R2	39 ohm
R3	270 ohm
R5	220 ohm
R6	68 ohm

Table 1. Crystal Measurements	
Crystal #	Series Resonance (Hz)
1	9,825,890
2	9,825,947
3	9,826,019
4	9,826,009
5	9,826,079
6	9,825,939
7	9,825,846
8	9,825,829
9	9,826,070
10	9,825,830
11	9,825,899
12	9,825,872
13	9,825,719
14	9,825,868
15	9,825,951
16	9,826,212
17	9,825,900
18	9,825,970
19	9,825,930
20	9,826,119

Note: Etched and drilled PC boards are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118. Price: Upper Sideband Filter—\$3; Lower Sideband Filter—\$3; Oscillator Circuit—\$3. A set of all three boards—\$7. Please include \$1.50 shipping per order.

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Fax: (207) 948-5157

Price Class: Complete kit of parts including

3 PC boards and a crystal, \$155;

add-on PA kit without enclosure, \$75;

with enclosure, \$135;

432 MHz preamp kit, \$30.

Enclosures available.

The key to the growth of amateur radio in the future is to use the spectrum space above 148 MHz—valuable frequencies which are coveted by other potential commercial users. Yet, many amateurs have been discouraged by both the high cost of commercially-available multimode transceivers and the complexity of older "do-it-yourself" designs.

Down East Microwave breaks through both barriers with the DEM 432K, an easy-to-build linear transverter which offers excellent performance at a reasonable price and uses state-of-the-art broadband design technology to eliminate most of the bench work necessary to fire up the kit when completed.

How It Works

The DEM 432K consists of three boards: a local oscillator (L70), a receive mixer and converter (R70), and a transmit mixer and converter (T70). All stages are truly linear, meaning any input mode can be reproduced faithfully. The combination of boards will upconvert your low-level transmitted signals from 28-30 MHz to 432-434 MHz, and will downconvert received signals in the opposite direction.

The LO multiplies a crystal frequency of 101.00 MHz four times to 404 MHz, then amplifies and buffers the output for stability. An on-board splitter gives you two outputs of +8 to +10 dBm, which feed both the transmit and receive converters. The only tuning adjustment which is made is to trim the crystal frequency right to 404.000 MHz—all other circuits are broadbanded.

The receive converter has NO tunable circuits, just a pair of Microwave Monolithic Integrated Circuits (MMICs) driving a Mini-Circuits mixer assembly. Overall conversion gain is about 10 to 12 dB, and an onboard GaAsFET preamplifier improves system gain to about 20 dB with a noise figure of about 0.5-0.6 dB.

The same is true for the transmit converter, which uses three MMICs to develop output at 70 cm. The nominal output is about +16 dBm linear, or close to 50 milliwatts of RF. Adding an S-AU4 power module will result in 15 to 20 watts of output power, depending on your power supply voltage.

Construction

I ordered the whole nine yards from Bill Olsen, getting all three boards plus the S-AU4 PA kit. After wandering around several electronics parts distributors, I located a pair of enclosures for the PA, as well as the entire transverter assembly (Photo C). This was a neat trick as I hadn't even started construction yet! Longtime Microwave Modules users will recognize the approach I took right away, se-

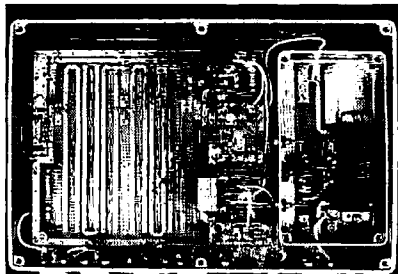


Photo A. The DEM 432K transverter kit (case not included). The receiver (R70) and transmitter (T70) boards are stacked underneath the LO (L70) board. The PA module (432PAK) is shown on the right.

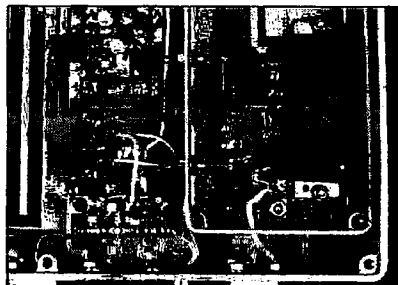


Photo B. Close-up view showing connections between the transverter and the PA modules. The small board at the bottom is the optional preamp (designed by Steve Kostro N2CEI).

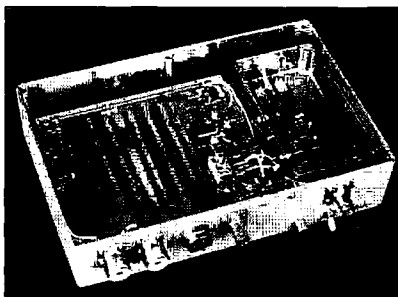


Photo C. All modules fit nicely in PAC-TEC die-cast enclosures (not included in kit).

lecting PAC-TEC UE-692-900 and UE-351-900 die-cast boxes.

Each of the boards and its associated parts comes in a zip-lock bag, and a nine-page manual with pictorial diagrams and schematics for assembly is included. The most complicated board to assemble is (as you might have guessed) the local oscillator. One note of caution: All of the boards make extensive

use of microwave chip capacitors, which are very small and easily lost! My "trick" is to double up a piece of masking tape on my working surface, then stick the components to it and pull them off one at a time as needed. The chip capacitors are secured with transparent tape to a small card which identifies them by value. Your best bet is to solder all of the capacitors from each group before moving on to the next. In addition, a few chip resistors (very tiny!) are also attached to the card. Make sure you use a low-wattage soldering iron and a good pair of precision needle-nose pliers to install all chip components.

Aside from these few precautions, kit building should proceed quickly. All of the MMICs are securely packaged and labeled, and the instructions provide a visual key as to package orientation and lead length. BFX89 transistors are used as the oscillator and first buffer, and one lead will need to be clipped from each. This is shown in the assembly manual. You'll also need to wind a few coils from #24 insulated wire on a 0.1" (#33) diameter drill bit. While tedious, this shouldn't take long. Make sure you scrape the insulation from the leads before attempting to solder them!

You can build the boards in any order you like. The local oscillator board has extra pads for a second complete local oscillator to allow switching band coverage for satellite operation. (The extra components can be ordered from Down East Microwave.) Use miniature Teflon coax for all of your interconnects between boards to keep losses down. Use care when installing the TUF-1 mixer assemblies! Don't bend the leads excessively, and watch the case orientation, as spelled out in the instructions.

Powering Up

About the only thing you'll have to do is get the local oscillator up and running. A VOM set to 250 or 500 mA scale is all that's required for the bare-bones setup, but a frequency counter would also help. After checking your component installation, apply 13.8 volts DC and rotate C1 through its range. You should see a definite peak on the VOM as the oscillator kicks in, and this should be very close to 101.00 MHz. LO current should be about 150-200 mA.

Next, check for 404 MHz output at both of the connections to the T70 and R70 mixers. If you can measure RF millivolts, anything from +7 to +10 dBm is acceptable. Trim C1 to get as close to frequency as possible—if not, add another turn to L1 and try again. Additional

Continued on page 75

Handi-Beacon

Turn your tape recorder into a beacon controller.

by Klaus Spies WB9YBM

The need for beacons extends beyond propagation tests. They are also very useful for range tests and equipment checks (two aspects seldom considered). Quite frequently, I have made an adjustment to my radio and not had anyone at home to help with a range test. To help solve this dilemma, I came up with a way to turn a transmitter into a useful beacon using a tape recorder and a simple interface.

My initial test setup consisted of a rubber band wrapped around a radio's microphone (to hold down the PTT) and placed near the speaker of a tape recorder. Unfortunately, this proved unreliable—if one of my cats knocked the microphone off of the tape deck or someone accidentally turned off the tape deck, I would lose both the station identification and test audio (to check readability at the noisy fringe area).

Beacon Tape Recorder Interface

This led to the development of the circuit shown in Figure 1. One operational amplifier acts as variable gain stage, to feed audio to the transceiver's microphone audio (U1A/U1C) from the tape deck's output. This direct connection eliminates any background noise feeding into the transceiver. The second operational amplifier (U1B/U1C) drives the audio into clip. The slopes of this signal are steep enough to be seen as digital by the 4538 timer (U2A/U2B) (see Table 1), which is wired as a retriggerable leading edge oscillator. When the audio starts, the 4538 is triggered, activating the transceiver's PTT. If for some reason the audio vanishes, the radio will toggle back into receive as determined by the time constant of the 4538 (calculated by $T=RC$), which I set for two seconds (plenty of time to ensure that the transceiver does not toggle between words).

For convenience, I typically use an endless-loop tape. For long tests, I am very careful about the trans-

mit time of my transceiver. For example, if I know that the power levels being used will cause a rapid heat-up of either the transceiver and/or the amplifier, I'll use a 60-second tape, with only about 30 seconds worth of talking, for a 50% duty cycle. If you find your system still gets unacceptably warm, try for 30% or 40% transmit time (for those who want to put up a high-powered beacon). A simple ID is usually sufficient; something like, "WB9YBM, Niles, Illinois-test" should both satisfy the FCC and provide a long enough transmission to let a mobile station drive in and out of several signal nulls. For propagation beacon applications, you may want to add information about your power level and antenna height. You can also offer a QSL in exchange for a reception report if you'd like an idea of how well your beacon is performing as well as help in studying propagation.

Since only half of the 4538 is utilized, I chose to make two independent beacons out of one circuit. There is still the need for only two ICs—the dual operational amplifier was upgraded to a quad package, keeping the project simple. If the same cassette tape is used for both beacons (each on a different band, using different antenna heights or types, or just different power levels), a stereo tape player can be used to feed both (either both tracks of the tape can initially be

recorded in monaural to provide identical information to both tapes—in which case, a generic identification will be preferred—or each track of the tape can contain separate information).

No special recorders are required; any cheap play-only deck will do. If you plan to put the beacon at a relatively inaccessible spot, the primary stipulation will be a good quality tape that will not degrade too quickly with high levels of use.

CW Beacon Applications

For a CW beacon, simply record CW on the endless loop tape and re-calculate the time constant of the 4538 as follows: If the recorded CW tone is 1 kHz, the 4538 will get triggered once every 0.001 seconds. Therefore, to avoid having the output of the 4538 give a steady output, its hang time must be longer than 0.001 seconds ($1/1,000$ Hz), but short enough to unkey at almost the same time as the CW tone on the tape. For other tone frequencies on the tape, just use the formula $1/f$.

If a CW tone and keying are desired (to feed CW tones to a VHF FM transceiver's audio input while at the same time keying the PTT line), you can use a 555 timer set to run at 1 kHz (the approximate center of the audio passband of most transceivers and a tone many people are most sensitive to) and

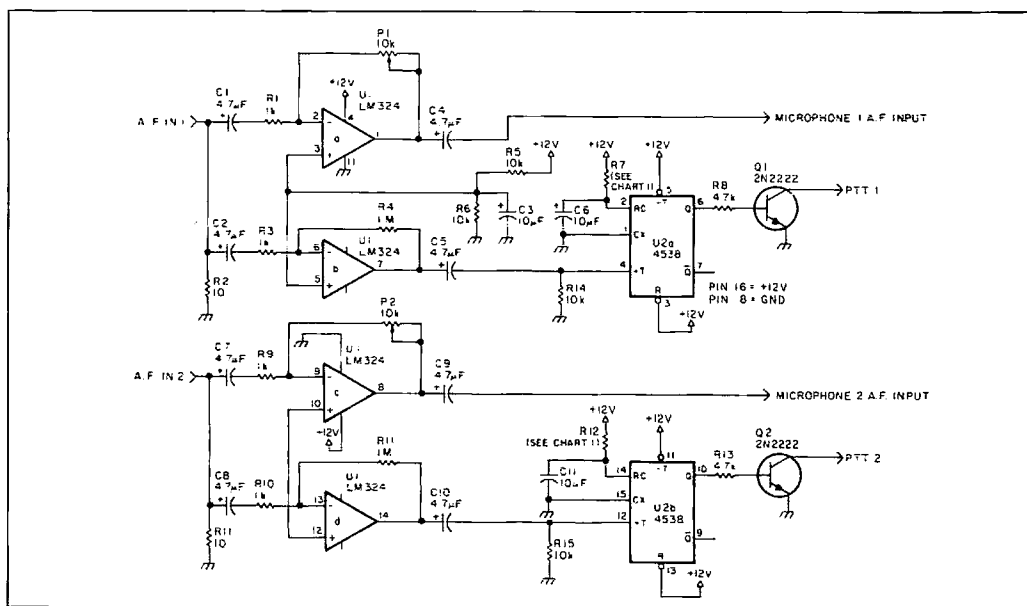


Figure 1. Tape deck to beacon transmitter interface circuit.

by Dick Goodman WA3USG

The SR4 Multimode Simplex Repeater

Alinco Electronics Inc.
438 Amapola Avenue, Unit 130
Torrance CA 90501
Telephone: (310) 618-8616;
Fax (310) 618-8758
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SR4-D—\$534.95

The next generation of store-and-forward voice controllers.

It is a great pleasure to see an equipment manufacturer make subtle improvements to a recognized good product. It tells me that they are not satisfied with "resting on their laurels." It also indicates that there are people who feel that radio amateurs are a progressive lot who like to experiment. Not only has this company improved their product, but they did it in a manner that I feel will encourage experimentation. The evolution of this product is not apparent from the look of its case or front panel but is quite obvious from a functional point of view.

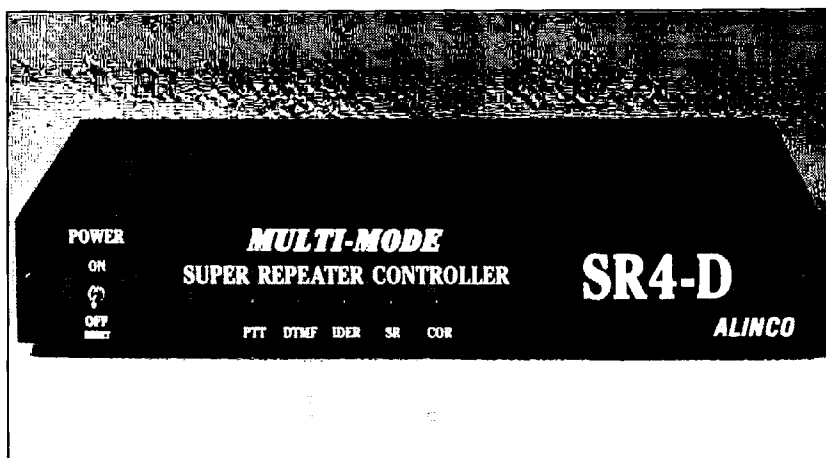
About 18 months ago, I had a chance to review a product known as the SR3 Simplex Repeater from Brainstorm Engineering in La Crescenta, California (73 *Amateur Radio Today*, May 1991, page 46). Brainstorm implemented several substantial internal enhancements to the SR3, and renamed it the SR4, then Alinco and Brainstorm joined forces. If you place the SR3 and SR4 side by side there are virtually no noticeable differences. Functionally, however, the SR4 has evolved into an extremely flexible system of integrated transceiver control.

Some Additional History

The first thing that I would like to say is that the SR4 is much more than a simplex repeater. Depending on the model of the SR4 acquired, it can also be a very capable full-duplex repeater controller. The SR4 retains all the functions of the SR3, with the addition of many more. The biggest improvement, however, is the flexibility with which the SR4 may be configured to interface with virtually any transceiver.

My review (identified above) provides a good background on this product, but for those of you who don't have access to this article, I will synopsise it here. I will then review the many enhancements and new functions offered by the SR4.

The simplex repeater is effectively a voice store-and-forward device. Hardware requirements are minimal. Only one voice-standard voice-grade transceiver and antenna are required for its operation. When the connected transceiver receives a sig-



The SR4 multimode simplex repeater from Alinco.

nal, the simplex repeater digitizes its audio output and stores it in solid-state memory. When the transmitting station finishes, the simplex repeater keys the same transceiver and plays back the captured audio, effectively repeating it to any user tuned to the transceiver's frequency. There are no duplexers involved and no desense (because the receiver and transmitter are never active at the same time). Even the originating station gets to hear his or her own signal as the transmission doesn't get repeated until the originating station drops carrier. While it isn't as conducive to back-and-forth chitchat as a full-duplex repeater, it's simple to set up and quite portable. And, since the SR3 and SR4 don't use any mechanical tape transport as the voice storage media, they are also quite reliable. Older simplex repeater systems used analog tape drives which were slow (they had to rewind before the received message could be repeated) and prone to mechanical problems.

The Physical Device

The Alinco SR4 is packaged almost identically to the SR3 (the only difference is in the front and rear panel labeling).

Both units are contained in attractive, strong black metal cases 10.5" wide by 6" deep by 1.75" high. The power requirements are 11.6 to 15 VDC at about 160 mA.

The documentation is excellent. It should be realized that the SR4 is a complex radio interfacing device. Almost all analog signal inputs and outputs, whether they be control, data, or audio, may be tailored via internal adjustments. The documentation goes into considerable detail on how to optimize each parameter. This device is an experimenter's dream! Providing that the person who is initially setting this up has a reasonable level of technical competence, I cannot foresee any transceiver or device that will not work well with the SR4.

SR4 Functionality

The SR4 comes in two models. The first, the SR4, will control one radio and functions as a simplex repeater (with voice ID and mailbox functions). The second, the SR4-D, will control two radios. As well as being a simplex repeater, it will also function as a full-duplex repeater controller. This review is applicable to the SR4-D.

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CIRCLE 55 ON READER SERVICE CARD

The SR4-D is capable of several functions. The primary function of simplex repeat has several improvements over the SR3. Perhaps the most dramatic is the Receive VOX method of COR detection. It is not necessary to pick off a hardware COR from the transceiver or have the transmitting station use CTCSS. The SR4-D will generate its own carrier detection from the audio output of the connected radio. The only requirement is that the audio must be squelched. Any signal-breaking squelch will generate an active COR and either start the unit recording in the simplex repeat mode or key the second transceiver in full-duplex repeat (if that mode is selected).

The Receive VOX COR detection has three internal adjustments: attack time, hang time, and overall sensitivity. Each of these is independently controlled via internal pots. Using the SR4-D with two old Heathkit HW-2036 transceivers yielded very reliable repeating in both the simplex and full-duplex modes once the RX VOX adjustments were optimized. Unless the transmit and receive frequencies are widely separated, a duplexer is still necessary in full-duplex repeat. Another versatile capability of the SR4-D is its ability to simplex repeat on one radio while full-duplex

position, the audio was noticeably better.

Additional Features

The SR4 has a plethora of additional features that will delight the experimenter and tinkerer! COR detection for simplex and full-duplex repeat may be achieved by several methods: by the receive VOX method described above, by listening for a CTCSS tone (with the optional TS32P decoder available directly from Brainstorm Engineering, 2948-1/2 Honolulu Ave., La Crescenta CA 91214; Tel: (818) 249-4383), or by sensing a hard voltage level change from the connected transceiver (with the optional HW2 Hardware Carrier Detector from Brainstorm).

Hardware COR from the radio may be either a positive or negative swing and may be as small a change as 300 mV. All audio levels in and out are fully adjustable via internal pots. The SR4 is also configurable to a wide range of microphone input circuit impedances via internal jumpers.

The SR4 has a full-featured DTMF decoder. Virtually any function of the unit may be controlled remotely. Commands sent to the SR4 will be verified by an acknowledgment tone. There will be a short tone if the command is accepted and a longer one if not. The SR4 may be completely

The SR4 has a plethora of additional features that will delight the experimenter and tinkerer!

repeating via the other. Both simplex and duplex repeat functions may be controlled via DTMF tones.

Voice ID and Voice Mail

The SR4 has a voice IDer that users can program with their own voice. This is done remotely via a DTMF-equipped transceiver. The activity timer, which controls the periodicity of the ID function, may be remotely DTMF programmed from one to 98 minutes. You are not limited to voice; you may use an electronic keyer and record a CW ID if desired. Voice ID messages may be recorded, played back, and erased at any time via DTMF control.

The voice mail function enables a user to store a voice (or any other audio) message for retrieval at a later time. The SR4 will only store one message at a time. When a message is stored, the SR4 generates a unique squelch tail to alert users. The message may be played as often as desired. When the voice message is erased, the squelch tail is removed.

The SR4 has a total of two minutes and 48 seconds of total audio storage capability. This is split between the simplex repeat, voice IDer, and voice mail functions. I tried both voice IDer and message functions. There are two audio sampling rates. In the low rate, the audio was a bit raspy but still quite acceptable for its intended use. In the high sampling rate

Inhibited from operating or enabled from an inhibited state via DTMF control. The power saver function may be enabled/disabled.

This is a useful feature which prevents the front panel LEDs from lighting to save power during battery operation. All repeat functions of either connected transceiver may be controlled. Either radio's receiver or transmitter interface to the SR4 may be turned on or off, and either radio may also be put in or out of the simplex or full-duplex repeat mode. The roger beep/courtesy tone may be enabled/disabled and all aspects of the voice mail or voice ID may be controlled. This includes recording, playing and clearing messages and voice IDs. The SR4 may also be inhibited from passing DTMF tones on the air via its repeat function. Finally, the SR4 has an auxiliary output which may be used to control a relay or similar device.

Soon to be released features are a multi-user voice mail system, 11 minutes of digital storage time and a simplex and duplex autopatch.

Writing a review for a device like the SR4 is difficult at best. I don't believe that any two individuals will use it in the same way. Reading the SR4's manual and experimenting with the unit itself will start the creative juices flowing. It is an excellent addition to your club's repeater or your home station.

HOMING IN

Number 11 on your Feedback card

Radio Direction Finding

Joe Moell, P.E., K0OV
PO Box 2508
Fullerton CA 92633

Computers Point the Way

Living in Southern California has its good and bad points, but one big advantage for hams is being able to go on hidden transmitter hunts all year long. Radio direction finding (RDF) enthusiasts in northern states and Canada have a few months of cold weather and icy roads ahead, so many clubs there will not be holding these contests (called foxhunts and T-hunts) until spring.

That doesn't mean you should forget about this part of ham radio, however. Now is the time to plan and build a better RDF setup, in anticipation of the thrill of victory when hunts resume. What will your new secret weapon be?

The "radar scope" display, described in "Homing In" for October and November 1992, generated lots of response. Readers like the two-dimensional view of the hidden signal, but some have had trouble finding suitable storage oscilloscopes. Furthermore, these scopes are bulky and difficult to power up in a vehicle.

Why not use a computer screen for the readout device? A laptop portable is small and lightweight. It works from its own batteries, or perhaps 12 volts from the vehicle. Best of all, the computer can "crunch" the data to aid in finding the most accurate bearing and navigating to the hidden T.

Heads Up!

Jerry Boyd WB8WFK of Albu-

querque, New Mexico, is a pioneer in computer-assisted mobile RDF. When I first met Jerry in October 1991, he had installed a continuous-turning potentiometer at the base of the mast for his four-element 2 meter T-hunting yagi (Photo A). It drove a dash-mounted meter that gave him a "heads-up" indication of antenna pointing direction.

This remote azimuth indicator is an easy weekend project. Figure 1 shows the schematic for it. Jerry used a surplus Bourne's precision linear taper pot (R1). U1 can be any op amp IC that works as a voltage follower at DC. Regulator U3 is used as an active voltage reference. R3 adjusts its output to +3.4 volts (corresponding to 340 degrees), measured at TP1.

Jerry's azimuth pot has 340 degrees of winding and a 20-degree dead zone. He says, "Between 340 and 359 degrees the arm of my pot goes open circuit. R6 prevents the output of U2 from floating when the pot is in this dead zone." Align the indicator so that when the antenna points forward, the pot is at the 180-degree setting and output voltage at TP2 is 1.8 volts. This puts the dead zone behind you where it has the least effect when T-hunting. Calibrate the meter by setting R8 for a 180-degree reading on M1 at this R1 setting. If you are not using a 100 microampere meter movement, change the values of R7 and R8 accordingly. Movements from 50 microamperes to 1 milliampere can be used with appropriate changes in these resistors.

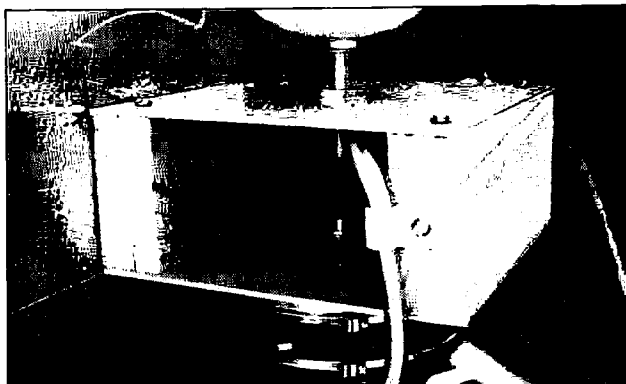


Photo A. This is how WB8WFK attaches the bottom of his mobile antenna mast to the azimuth-sensing potentiometer. The assembly mounts to the inside of the driver-side door.

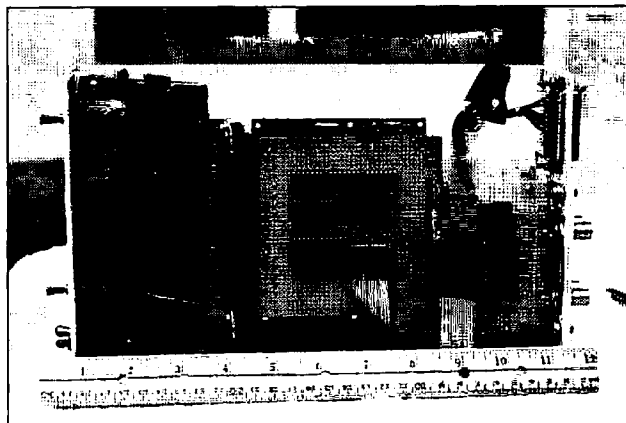


Photo B. Interior view of the interface box containing the MUX, A/D converter and Micromint computer board. BNC jacks on the rear are analog data inputs. (Photo by WB8WFK.)

Going Digital

Today, WB8WFK's huntmobile boasts an integrated digital bearing-taking, storage, and display system. The nerve center of the system is an interface box (Photo B) that includes

a home-brew eight-channel analog multiplexer (MUX), analog-to-digital (A/D) converter, and a Micromint Z8 single-board computer (Figure 2). Analog signals representing antenna azimuth, S-meter, and RF attenu-

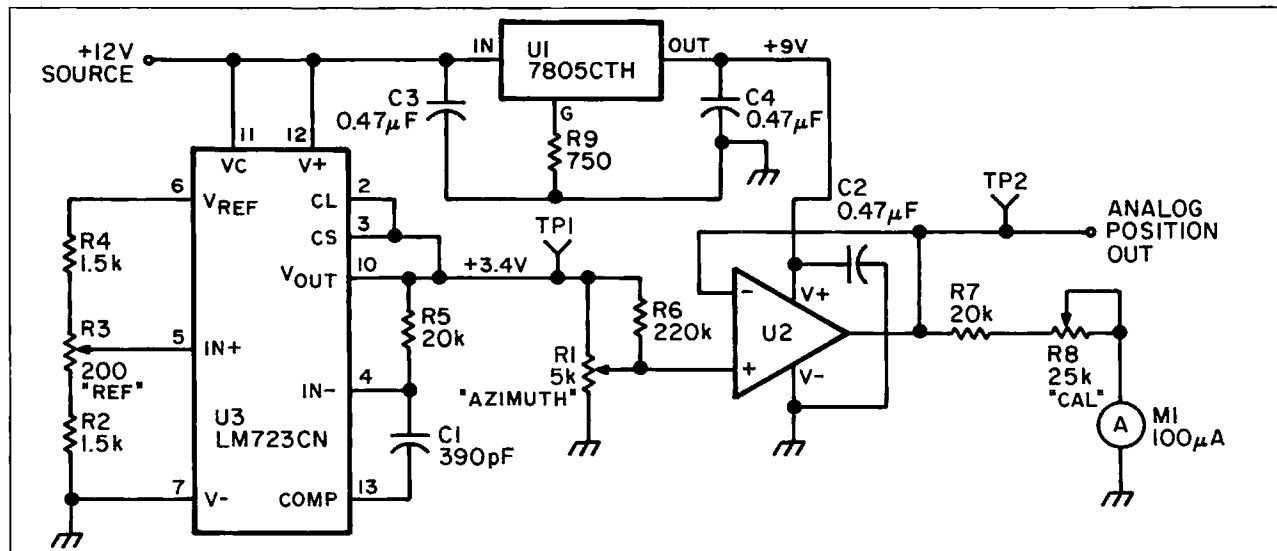


Figure 1. Schematic of the antenna position display unit. R1 is the continuous-turning potentiometer. M1 indicates direction. The analog output goes to the MUX and A/D converter.

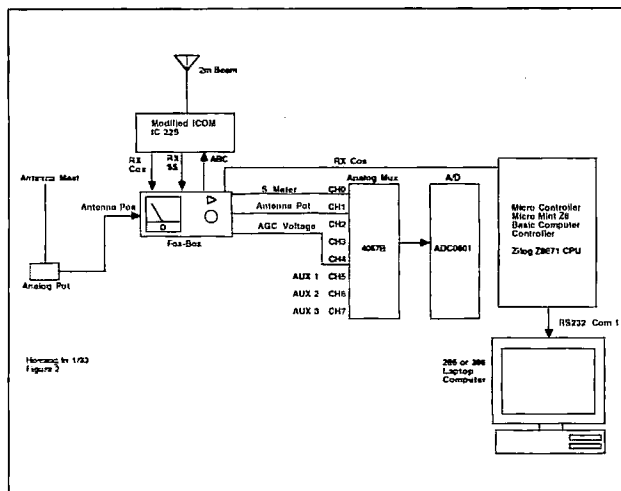


Figure 2. Block diagram of WB8WFK's system. Analog outputs of the fox-box are digitized and then processed by the controller and laptop computer. Extra MUX channels are available for inputs from a flux-gate compass and digital shaft encoder.

ation go from the box to the MUX. The Z8 takes the digitized data and transmits it to a PC-compatible portable computer via the RS-232 port. The computer is programmed to use the serial azimuth and signal strength data to compute and display polar plots (Figure 3).

"Ed James KA8JMW loaned me a 386 laptop (Photo C) for the display unit," Jerry says. "But even with this fast computer, the plotting is not done in real time. I push a button to trigger a data acquisition. The program takes 256 samples of antenna angle and signal strength and stores them in an array. It samples at about 10 times a second. Then it quits sampling, draws the plot, and computes the best bearing. "Next, I have the option of scaling the plot. Say the S-meter reading was low, so the trace was small. I can enter a scale factor to expand the plot to full size. I'm thinking of making the software compute the scale factor automatically."

Like most VHF T-hunters who use beams, WB8WFK turns his mobile antenna mast manually. The 25-



Photo C. WB8WFK's car is ready for the hunt. The analog fox-box and digital interface unit are on the dash. The computer (protected by pillows) has replaced a human in the passenger's seat. (Photo by WB8WFK.)

direction of interest and improves the accuracy of his bearings.

Jerry adds, "One of the software features is that it walks through the data array to find the signal peak and the corresponding angle to the peak. On the screen I see the polar plot, plus a status panel with best bearing details on the side.

"I used it on a real hunt Sunday. It

gram for data display is in Microsoft Quick Basic 4.5. On my old XT it takes 45 seconds to do the plot. On the 386 laptop, it's five seconds." Jerry says that other computers besides IBM compatibles could be adapted to this system. "Ed has a Radio Shack Model 100 and we're thinking of seeing if we can make a version of the software that runs on it, using an X-Y plot of signal strength versus azimuth instead of a polar display. Model 100s don't have the screen resolution to do a polar plot, but they're real cheap at hamfests."

Next month's "Homing In" will have more details on the software features, plus schematics and parts information for the interface box. Jerry's strong signal attenuation scheme will also be described.

I'll bet other readers are working on digital processing for their RDF equipment. If so, I'd like to hear about it. Write and tell me what you are doing. Better yet, get out the camera, take some pictures, and send them to me. Let's share ideas.

“Fluctuating signals and noise show up as a ‘spikey’ display compared to steady signals, which produce well-rounded lobes.”

show up as a “spikey” display compared to steady signals, which produce well-rounded lobes (Figure 5).

On some hunts there is only one apparent signal direction, but the amplitude fluctuates due to nearby moving objects, airplane flutter, or power changes by the transmitter hider. When that happens, Jerry sweeps back and forth across the signal when taking data, instead of turning the antenna in a full circle. This builds up multiple traces in the

shows direct signal and reflections real nicely. What really surprised the other hunters was that after the hunt I could play back the bearings. I have a feature in the software that saves data to a disk file for later review."

It's All in the Software

"The Z8 control program is written in Tiny Basic and is downloaded to the Z8 by the DIGDF program on the PC," Jerry says. "The pro-

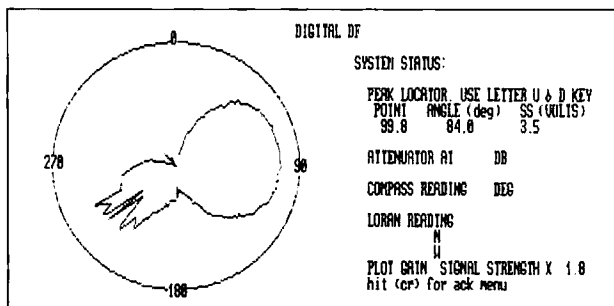


Figure 3. Rotating a high gain beam produces this pattern on the computer screen when there are no fluctuations, reflections, or multipath. (Of course, this never seems to happen on an actual hunt!)

Figure 4. A complete screen dump from WB8WFK's digital RDF system in the field. It's easy to tell the direct signal from the fluctuating reflection. The peak locator shows that maximum signal is coming from 84 degrees with respect to the vehicle heading. The S-meter reading was multiplied by 1.8 for a full-size plot. Attenuation, compass, and LORAN indications have not been fully implemented into this software version.

Figure 5. This plot was taken in a supermarket parking lot on an Albuquerque T-hunt. The spikes at zero degrees represent noise from power lines ahead of the vehicle. The hidden T is to the left and there is reflected signal from the right.

HAMS WITH CLASS

Number 12 on your Feedback card

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Do You Have the Write Stuff?

Every time a new issue or controversy comes up that affects our lives in some way, we as American citizens have the right and the obligation to let our elected officials know what our points of view are on the matter. Whenever an important new rule is being proposed that affects the amateur radio community, most of us have strong feelings pro or con on the issue before us. Usually, some member of an active radio club will organize an effort to make it real easy for the membership to express their opinions by signing a petition or by getting a massive letter-writing campaign going.

As an amateur radio teacher in an intermediate school, I like to seize upon these opportunities to teach a civics lesson and a language arts lesson as well. After we discuss the issue and the children do the required research to present their arguments to the rest of the class, we talk about what our best options are to get our opinions across to the people with the power to enact legislation and to make changes.

In 1990, the United States Postal Service handled about 60 billion first-class letters and packages. That means that the average American household sent about 620 letters that year. Were any of them sent to a senator, representative, FCC Commissioner, or other government official? In most households, the response to that question would be "no."

It's important for children to know that writing to Congress or other branches of the government is still one of the most effective things that a citizen, as an indi-

vidual, can do. According to the Office of Legislative Information and Bill Status, thousands of bills get introduced during each session of Congress. By speaking out on any of these bills, you automatically increase your "political clout." Many members of Congress consider opinions expressed in a letter to represent at least 100 votes.

Guidelines for Writing to Congress

The children always enjoy writing their opinions in a letter when the point about its importance is made clear to them. I use the following guidelines with my classes to ensure the most effective response.

When writing to Congress, personal letters are preferable to preprinted cards. A veteran lobbyist says that, "Handwritten letters show that a person has taken the time to think about an issue and has a viewpoint on it. The more people write out of their own convictions, the more likely they are to get a response."

Write about one topic at a time. Make your point and don't confuse the issue with other extraneous information.

Letters that are short and to the point are more likely to get read. Legislators often use letters simply to get a count of the number of people who support or oppose different bills.

In your first sentence, state that you oppose or support a specific bill or issue, so it will be easy to tell which side you're on.

Postcards are easier to send and easier to read.

If you're referring to a bill, make sure you have the right number and title. This is very important due to the large number of bills that get introduced every year. You can get this information by calling your local Congressional office. Put some kids to work on this as-



Photo A. Eighth graders Matt KB2QJ and Bianca are examples of children who love to get involved with local, national and international issues through ham radio.

pect of the preparation and research. It's good experience for them to start to learn their way around their own government.

State your case. Show that you understand the issue and explain how it affects you, your family, and your community.

If it's appropriate, send a "thank you" letter once the issue has been decided. According to one expert, for every 100 to 250 letters that legislators receive in a week, only about two are "thank you" letters. If you send a thank you letter, you may stand out enough that they'll remember you the next time you write.

One of our goals as educators, no matter what subject area we teach, should be to make sure that our students know the importance of being well informed, and then know what acceptable channels to go through are

available to let their voices be heard. Teachers using amateur radio in their classes have many unique opportunities to teach about the responsibilities that go along with being a good citizen of their community, their state, their country, and of the planet. The nice thing about it is that there's always something going on somewhere either locally, nationally, or internationally that can lead into a great classroom lesson.

Besides liking the idea of making their own statements, my classes eagerly await the reply comments. Everyone in the class gets excited when official-looking correspondence comes to the school, addressed to them.

If you've had some interesting experiences getting your classes involved with the system of how government works, please write to me so we can share the ideas.

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CIRCLE 140 ON READER SERVICE CARD

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041

Using The Passive Double-Balanced Mixer (DBM)

The double-balanced mixer (DBM) is a terribly useful RF electronic component. It can be used in receivers, transmitters, test equipment and many other applications. It provides good mixing action with little of the hassle and headaches that accompany active mixers (transistors, ICs, etc.). The DBM is truly a versatile little beastie.

Figure 1 shows the generic circuit for the DBM. The mixing action is caused by a diode ring (D1 through D4), which is not, by the way, the same thing as a full-wave bridge rectifier (look at the diode directions). Coupling into and out of the circuit is provided by the RF input (RF), local oscillator (LO) and intermediate frequency (IF) ports; these are coupled via broadband RF transformers.

The Mini-Circuits SRA Series

While it is relatively easy to make working DBMs using signal diodes and toroid transformers, it's just as easy to buy high quality parts from a source such as Mini-Circuits (P.O. Box 350166, Brooklyn NY 11235-0003; 718-934-4500). Their SRA and SBL series DBMs are used extensively in ham construction projects shown in various publications over the years. The SRA-1 works from 500 kHz to 500 MHz (both LO and RF), and produces an IF output of DC to 500 MHz, depending on the LO and RF frequencies; the related SRA-1-1 works down to 100 kHz. Another model, SRA-2, works over the range 1 to 1,000 MHz (RF/LO), and produces IF outputs in the range 500 kHz to 500 MHz. The SBL series is similar to the SRA, but they are somewhat smaller. Prices in small quantities are in the \$15 range (consult the Mini-Circuits catalog for current pricing of any particular model).

The SRA-x devices come in a small, shielded metal housing that is 0.4 inches tall, 0.4 inches wide, and 0.8 inches long. It has eight pins on the bottom side, spaced 0.100 inches apart (see Figure 2). The pin spacing is the same as for most dual-inline package (DIP) integrated circuits, so the SRA series DBMs can be used on the standard perforated board that many hams like to use for construction. The number 1 pin indicated by the insulation around the pin is blue in color. All other pins are either connected to the case or embedded in gray or white insulation material. The pin numbers are arranged in zigzag order so that all of the odd numbered pins (1,3,5,7) are on the same side, and

the even numbered pins (2,4,6,8) are on the opposite side.

For the SRA-1 and SRA-1-1, which are probably the most popular with ham operators, the following pinouts are found:

Local oscillator: 8
RF input: 1
IF output: 3,4
(must be tied together)
Case ground: 2
Other ground: 5,6,7

The SRA-2 is similar, except that the RF input is placed on pins 3 and 4 (tied together), while the IF output is taken from pin no. 1. There are other models than SRA-1, SRA-1-1 and SRA-2, and these may have different pinouts than shown here. Consult the Mini-Circuits data for particulars.

The electrical performance of the SRA series DBMs is impressive for such low-cost parts. Isolation of the LO-RF circuits is on the order of 25 dB at the high end of the frequency range, and 50 dB at the low end. Similar numbers are found for LO-IF isolation as well. They use a +7 dBm LO signal, and can handle up to +1 dBm RF signals; these translate to 15 mW (15.8 mV) and 1.26 mW (7.9 mV) dissipated in a 50-ohm resistive load, respectively. The standard RF system impedance (50 ohms) is used for the SRA-series inputs and outputs.

Conversion loss in the passive mixers ranges from 6.5 to 8.5 dB, and this is easily made up with a simple amplifier if it can't be tolerated. In fact, the Mini-Circuits MAR-xx series of MMIC amplifier devices can easily be used for this purpose. One of Mini-Circuits other products is a series of active double-balanced mixers, in a similar case as the SRA series. These devices place an amplifier and DBM inside the same housing. The UNCL-X1 is similar to the SRA-1, except that it provides an output buffer for the IF port. The conversion gain (not loss) is 0.5 to 1 dB over the 1 to 500 MHz frequency range. The UNCL-R1 places the amplifier ahead of the RF port of the mixer, so it can accommodate RF signals up to -10 dBm, but also those that are considerably -10 dB weaker than will operate with the SRA-1. Conversion gain for the UNCL-R1 is 2 to 5 dB. The UNCL-L1 places the amplifier ahead of the DBM LO port, so it can accommodate weak LO sources. Conversion loss (not gain) is on the same order as for the SRA-1. The power requirements for these devices are similar: 12 VDC at 35 mA or so.

Figure 3 shows a typical "generic" circuit for the SRA-1 and SRA-1-1 mixers. The RF, LO and IF ports are protected by DC-blocking capacitors. These capacitors are necessary because the DBM must often operate in circuits that have a non-zero DC level,

or with signals that have a considerable DC component. The DC can burn out the windings of the input and output transformers. Of course, if there is no possibility of that happening in your particular application, then don't worry too much about the capacitors. In general, 0.01 μ F disk ceramic capacitors will work in the HF region, while 0.001 μ F (or even 100 pF) will work in the VHF region.

Notice that the two IF pins (3 and 4) are tied together. This connection is necessary, or else the device won't work properly. Also connected together are the ground pins (2, 5, 6 and 7). All of these pins must be grounded for proper operation, even though pin no. 2 is only the case ground (it serves to shield the innards of the device).

Any number of output circuits can be accommodated, so long as they

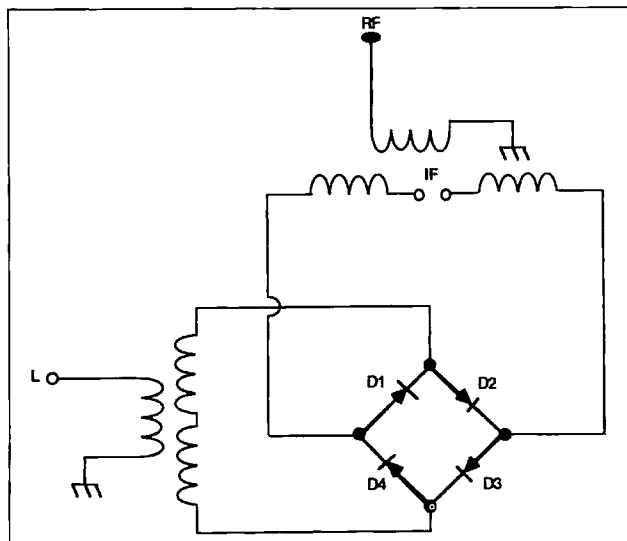


Figure 1. Circuit for a double-balanced mixer.

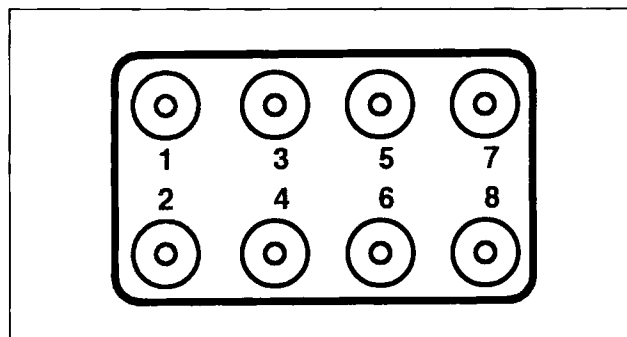


Figure 2. Pinouts for the Mini-Circuits SRA-series.

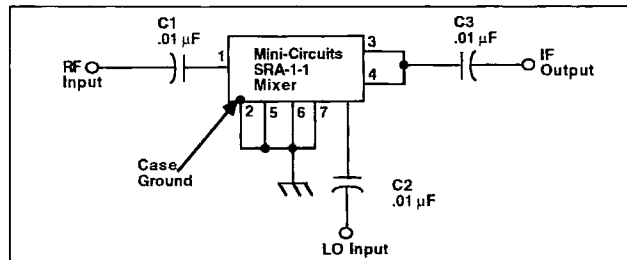


Figure 3. Generic circuit for the SRA-1 and SRA-1-1. The SRA-2 uses slightly different pinouts.

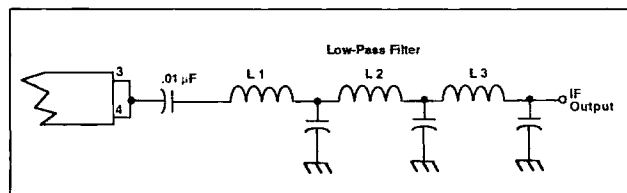


Figure 4. Low-pass filter output circuit.

are a reasonable match to the 50-ohm impedance of the SRA-1 and SRA-1-1 devices. A double-balanced mixer has some interesting properties. For example, it is more free of harmonics than other mixers, and it suppresses the LO and RF signals in the output. Thus, the spectrum of the output signal consists of the sum and difference (RF \pm LO) IF signals. A frequency-selective circuit will determine which one gets through to the rest of the circuits. One popular output circuit is a low-pass filter (Figure 4) that will pass only the difference signal. Alternatively, a high-pass filter will pass only the sum signal. This circuit allows considerable latitude, so long as the desired output frequency is within the passband of the filter. For specific IF frequencies (e.g., 455 kHz, 10.7 MHz, 8.83 MHz) used in receivers, a tuned bandpass filter circuit is needed.

A Useful DBM for the Workbench

Like many amateurs who have an electronic workbench in the basement laboratory, I have a goulash collection of signal sources bought new, bought used at hamfests, home-brewed, or obtained from goodness knows where in my 33 years as a ham. In order to obtain certain specific frequencies, however, I sometimes have to resort to using a DBM. Photo A shows my "test DBM." It consists of a Mini-Circuits SRA-1-1 mounted in an ITT/Pomona Model 2417 box. The cir-

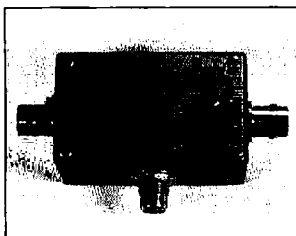


Photo A. DBM packaged for use on testbench.

cuit is the same as Figure 3, except that for stability I placed 1 dB Mini-Circuits' fixed attenuators in series with the RF, LO and IF ports. These attenuators keep the impedance stable, even when the source or load impedance is either not 50 ohms, or varies. The variation does not affect the SRA-1-1, but has affected some circuits that I've been working on. The added loss is reasonable for the stability gained.

By the way, my new book, *Receiver Antenna Handbook* (HighText Publications, Inc., 7128 Miramar Road, #15, San Diego CA 92121) is about ready for publication. Although it deals with receiver antennas, there is much material for ham operators as well. My other antenna book, *Practical Antenna Handbook*, is more in tune with hams, and is available from TAB/McGraw-Hill (Blue Ridge Summit PA 17294) for \$21.95 (use catalog number 3270).

HAM HELP

Number 14 on your Feedback card

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS 73 MAG Message Area #4. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

We wish to announce that Roxanne Delmage VE3VON, and Craig Delmage VE3KKU, are the current QSL Managers for 9L3BM.

I recently purchased a Hallicrafter SX-111 and HT-37 (matching receiver and transmitter). I am looking for a manual and/or schematic for this 1960s equipment. I will pay for copies. Brian Angel, 825 1/2 Wilson Ave., Ames IA 50010. (515) 232-7817.

Does anyone know where I can get info on the duties and responsibilities of Merchant Marines Officers? I'll take books, tapes, or any other educational materials. Please write and let me know what you have and how much \$ you want for it. Ed Melanson, RFD #2, Box 510, Thomdike, ME 04986.

Help! I just purchased a Radio Shack Model 102 laptop, and I'm looking for software, hardware and publication sources. I could es-

pecially use ham software, a spreadsheet, modem cable, printer cable. Please write or call, Brent Putnam N8UBD, 12110 Mayfield Rd. #6, Cleveland OH; (216) 721-2019. Or e-mail to bwp2@po.cwru.edu on college internet.

Can anyone help me locate Brian Key N5LNL? This station is with the military somewhere in Venezuela, not at the call book address. N5LNL was my first CW contact but I cannot find the proper address to send QSL. If you have any information, please contact Gene Kohring N8QWM, 1647 Millville-Shandon Rd., Hamilton OH 45013-9611. Thank you.

Manual/Schematic? B&K 445, EICO 330, EICO 379, SEMCORE RC115, TS-888. Marvin Moss WAUXJ, Box 28601, Atlanta GA 30358.

Newly licensed Ham, permanently disabled, no benefits, seeking goodwill donations of Ham equipment and related items. If it works, I'll take it. No item too big or too small. Can repair if minor. Will reimburse shipping and postage. I am for the most part, a listener. Age and external appearance of equipment is not a factor if it is functional. Cornell Howard N8TOJ, 231 Fenwick Dr., New Carlisle OH 45344.

I am looking for the diagrams and user/service manuals for my surplus communications receivers: RACAL HF 1-30 MHz, Model 1220 DRG#41880/D Serial #1551; RACAL VLF Converter NC-RA-6337A, Serial #260; CEI VLF-354 1-600 kHz Receiver, Serial #7. I will compensate for Xerox/mailling. Yuri Dzyuba VE2XLT (ex UB5LT), 3150 Rosemont #15, Montreal PQ H1Y-1M5 Canada.

ID-8 Automatic Morse Station Identifier

Compatible with Commercial, Public Safety, and Amateur Radio applications. Uses include Repeater Identifiers, Base Station Identifiers, Beacons, CW Memory Keys, etc. Great for FCC ID Compliance.

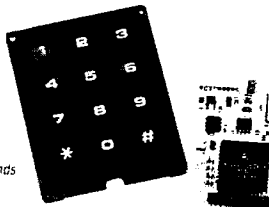
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- CMOS microprocessor for low voltage, low current operation, 5 to 20 VDC, unregulated at 5mA
- Low distortion, low impedance, adjustable sine-wave output, 0 to 4 volts peak to peak
- Crystal controlled for high accuracy
- Transmitter PTT output (to key transmitter while ID is being sent) is an open collector transistor that will handle 80 VDC at 300mA
- Field programmable with SUPPLIED keyboard
- Confirmation tone to indicate accepted parameter, plus tones to indicate programming error
- All programming is stored in a non-volatile EEPROM which may be altered at any time
- Message length over 200 characters long
- Trigger ID with active high or low
- Inhibit ID with active high or low. Will hold off ID until channel is clear of traffic
- Generates repeater courtesy tone at end of user transmission if enabled
- Double sided tape and mounting hardware supplied for quick mounting
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- Full one year warranty, when returned to the factory for repair
- Immediate one day delivery

Programmable Features

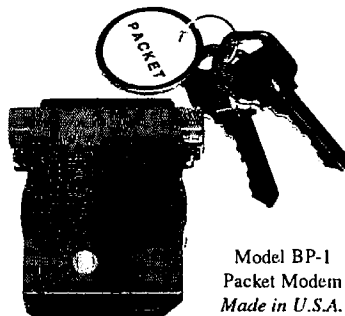
- Eight programmable, selectable messages
- CW speed from 1 to 99 WPM
- ID interval timer from 1-99 minutes
- ID hold off timer from 0-99 seconds
- CW tone frequency from 100 Hz to 3000 Hz
- Front porch delay interval from 0 to 9.9 seconds
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Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

TV Camera Lighting

The minimum light sensitivity of TV cameras has improved dramatically in the past few years. I used to have a few bright floodlamps in my shack in order to provide enough light for my old color TV camera. It worked great outdoors in bright sunlight, but was dreadful inside. It needed 50 lux minimum light level to produce a good image. The "lux" rating is a light level corresponding to one lumen per square meter (approximately the light produced one meter from a single candle).

Even some of the newer cameras still require some attention to the lighting in your shack to come up with a decent image. Until now, TV cameras that were more sensitive than your eye were unaffordable.

The GBC CCD-200

I recently obtained a new offering from CCTV Corporation, 315 Hudson St., New York, NY 10013; (800) 221-2240, (212) 989-4433. Their new model CCD-200 B/W TV camera has some eye-opening specifications. This camera is somewhat smaller than a pack of cigarettes, has an automatic electronic shutter and includes a built-in microphone. The most amazing parts of it are the light sensitivity rating of 0.02 lux and the special \$204.50 price for 73 readers!

I first tested out the camera in a room with somewhat dim lighting: just one table lamp. I was amazed to find that everything in the room appeared brighter on the TV screen than it appeared with my eyes. I pointed the camera through a doorway into a dark room; the camera picked up objects that I could barely even see. The resolution was excellent (425 lines) and the microphone worked well. The wide range of the electronic shutter allowed me to look at the darkest portion of the room and compensate quickly when I pointed it directly at the lamp. You can even point this camera directly at the sun without ill effect (something you couldn't do in the old days with vidicon tubes).

Build Your Own Nightscope

I noticed that the CCD-200 was very sensitive to the infrared spectrum. It could detect the hot tip of a soldering iron, see blood vessels underneath my skin and see the pulsing infrared output of my VCR's remote control (invisible to the naked eye). I turned out the light, and found that the output of the remote control could illuminate a completely dark room when viewed through the TV camera.

I've always dreamed of owning my own Nightscope. It would be a real thrill to actually see in the dark.

A Nightscope uses a high-intensity infrared (IR) source to illuminate the scene and an IR-sensitive detector/light amplification scheme that views the area. It's all a very complicated and expensive affair occasionally obtainable through military surplus outlets.

The prospect of building my own Nightscope prompted me to run down to my local Radio Shack and browse through their LED section. I found an appropriate candidate in their high-output infrared LED (model #276-143b). I grabbed a handful of these and headed back home to the workbench. I mounted two of these on a breadboard, along with a current-limiting resistor for each LED (see Figure 1). Just attach the LED board to the power supply you use for your TV camera. For a 9-volt supply use 270-ohm resistors; for 12 volts or more use 470 ohms. Each LED draws about 25 milliamps.

I put the LED board into a small plastic project box and attached it to the top of the CCD-200 with velcro. I switched off the room light and turned on the TV camera/infrared LED system. I was amazed! It was as if the two LEDs were headlights illuminating whatever I pointed the camera at. Even though I was sitting in total darkness, I could clearly read labels and see objects up to six feet away on my TV monitor. To make sure that my TV set wasn't providing any illumination, I checked out the TV camera/LED system in a dark

hallway with the same results. The only visible indication that the LEDs are operating is a very dim red glow if you stare directly into the tops of the LEDs in a totally dark room.

To light up a larger room, you may want to add more LEDs to the system, but I found that even just one LED worked fairly well.

To make a portable Nightscope, just add a small portable TV monitor (such as the Radio Shack Pocketvision 26, RS# 16-163) and a battery pack; you can now literally see in the dark.

Although it is a visible light source, you can really light up a room with one of the newer jumbo red LEDs. A good one is the jumbo 5000 (Radio Shack# 276-086).

Security Applications

The security applications of this system are intriguing. You can mount the CCD-200 and the LED array in your repeater site, your ham shack or your clubhouse and observe any intruders via an ATV link without their being aware of the camera (after all, everything will appear totally dark to their eyes). If the intruders use a flashlight, the whole room will light up like it was broad daylight.

You can have the infrared ATV link (and VCR) come up whenever a security motion sensor (or magnetic window/door sensor) is activated. Instead of your normal ATV repeater ID, you'll have a bird's-eye view of the intruders.

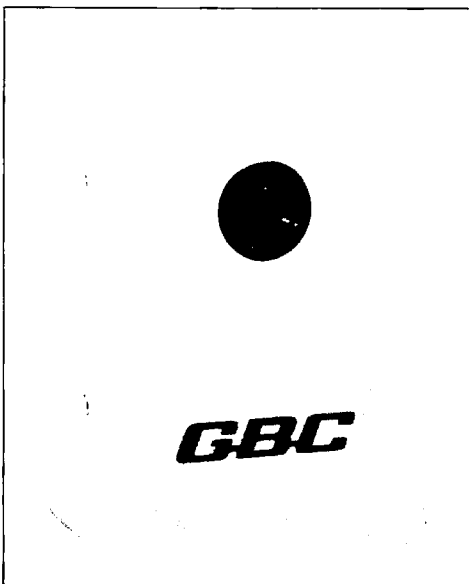


Photo A. The CCTV Corporation CCD-200 low-light level B/W TV camera.

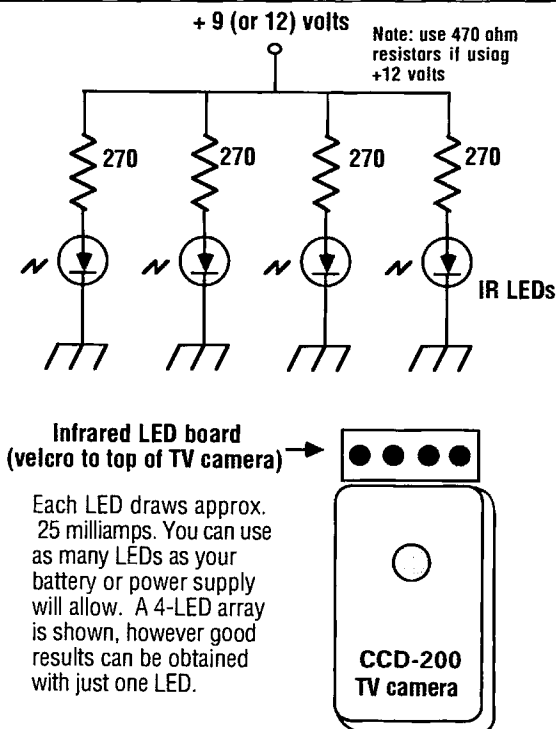
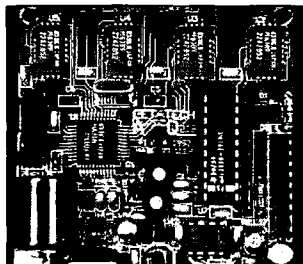


Figure 1. An array of high-output infrared LEDs mounted above the CCD-200 TV camera will provide enough illumination to light up a small room. Since the output is all in the infrared spectrum, the room will appear completely dark with the naked eye. For 9-volt operation use 270-ohm resistors; for 12 volts use 470 ohms.

NEW PRODUCTS

Number 17 on your Feedback card

Compiled by Hope Currier

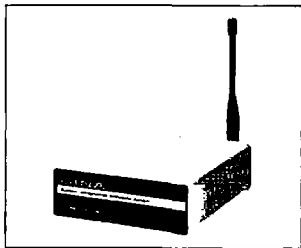


GET-TECH

GET-TECH has released its digital voice recorder, AUDIO Q218. This unit will record up to 218 seconds of speech. With four se-

lectable sample rates, up to eight different variable-length messages may be stored. Two separately adjustable audio outputs are provided. One high-level output will drive a speaker to 400 mW; the other may be used for output to an external amplifier or transmitter. An on-board regulator allows use from 8 to 15 VDC. Also included is an open collector output for keying a transmitter or external device during playback. The 2.5" x 2.5" unit comes fully assembled and tested, including battery backup and 4 meg RAM.

The AUDIO Q-218 is priced at \$149, plus S & H. For more information, contact GET-TECH, 201 Riley Road, New Windsor NY 12553; (914) 564-5347. Or circle Reader Service No. 203.



GRE AMERICA

GRE America has introduced GINA, Global Integrated Network Access, a wireless data transceiver that transmits and receives data at rates up to 128K baud. GINA eliminates the expense, hassles and restrictions of wire connections, while providing reliable data communications. It utilizes spread spectrum technology, which is highly immune to interference. GINA can be incorporated into a wide variety of applica-

Hamtronics, Inc. has published their new "January 1993" catalog, which contains 40 pages of kits and wired units for amateur radio, two-way shops, scientific and industrial radio users, and OEMs. It features two new products: a digital voice recorder and a low-cost DTMF controller. The DVR-1 digital voice recorder may be used as a voice ID for repeaters, contest CQ caller, or radio scratchpad. It records up to 20 seconds of real voice audio in one or multiple message segments and plays back through a repeater or small speaker.

The TD-4 DTMF controller provides one latching output based on four-digit commands to turn any circuit on and off. It was

HAMTRONICS

designed especially for use as a selective calling unit to be used with any receiver or transceiver to allow the speaker to be muted until someone wanting to call you sends the appropriate DTMF command to open the speaker.

These new products are added to the selection of VHF and UHF FM transmitters, receivers, power amplifiers, converters, preamps, repeaters, DTMF controllers, autopatches and digital radio modems which Hamtronics has manufactured for over 30 years. To receive a copy of this new catalog, contact Hamtronics, Inc., 65-F Moul Road, Hilton NY 14468-9535; (716) 392-9430, Fax: (716) 392-9420. For foreign mail, please send \$2 to defray postage.

PAKTEK INC.

PAKTEK Inc. is now offering the TOOLPAKS product line. The TOOLPAK original is a backpack tool organizer that secures over 100 of your most needed and important tools; the FANNYPAK is a convenient way to carry those few tools you just can't be without. Perfect for Field Day or remote locations, TOOLPAKS eliminate chasing down tools, keeping those days in the field fun and exciting. FANNYPAK has room enough for your portable and all the extra

batteries, leaving both of your hands free. Made of durable abrasion- and puncture-resistant Cordura, the TOOLPAKS haul like a pack and open like a zippered file cabinet, keeping you organized and helping you work more efficiently.

For prices and more information, contact PAKTEK Inc., 7307 82nd St. Ct. S.W., Tacoma WA 98498; (800) 258-8458, Fax: (206) 589-1091. Or circle Reader Service No. 201.

tions, including automation, data acquisition and control, security systems and wireless network systems, plus other industries where remote or point-to-point data transmission is necessary. Because GINA utilizes spread spectrum technology, information can be sent transparently, penetrating

walls, floors, ceilings and concrete, while still maintaining clear data transmission.

For the price and more information, contact GRE America, Inc., 425 Harbor Blvd., Belmont CA 94002; (415) 591-1400, Fax: (415) 591-2001. Or circle Reader Service No. 202.

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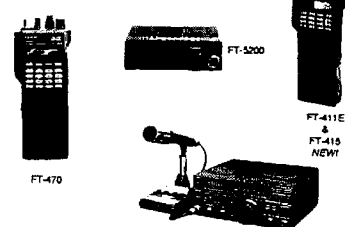
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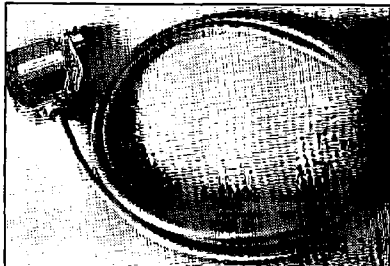
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j-COM has introduced a line of transceiver control computer interface cables designed to interface personal computers with all receivers and transceivers which have the ability to be controlled over a serial TTL link. The j-COM interface cable requires no external power supply. The unit requires only 3.5 mA of total power for ICOM and Yaesu models, and 6 mA for Kenwood. Removing the external power supply and its associated cables significantly reduces the susceptibility of the interface to RFI from the transmitter. Emitted RF noise is also reduced. The entire interface has been sandwiched into the shielded hood of a DB-25 connector compatible with the serial interface



assembled and ready to plug in. All four are priced at \$54.95, plus \$5 S & H. j-COM provides a 30-day money-back guarantee and a 90-day parts and labor warranty. Contact j-COM, Box 194, Ben Lomond CA 95005; (408) 335-9120, Fax: (408) 335-9121. Or circle Reader Service No. 205.

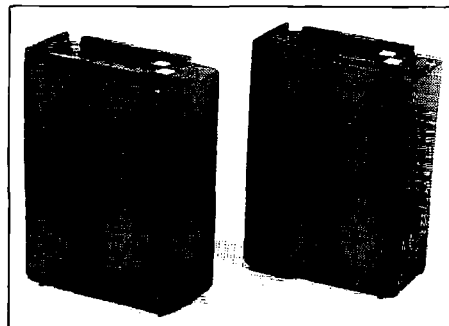
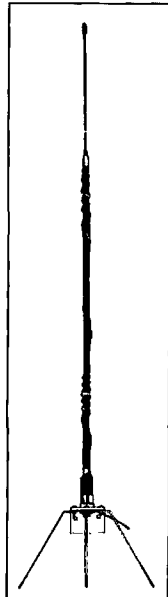
of most PC compatible computers. j-COM also supplies an optional DB-9 to DB-25 adapter for use with computers using the smaller size "AT" connector. Because the interface is a direct replacement for the manufacturer's own units, it is fully compatible with all rig control software.

The four models of interface cable come completely

A.S.A.

A.S.A. has introduced a product ideal for new hams—an affordable 2 meter colinear base station antenna with unbelievable gain. The model 9209 is made up of four parts and takes approximately 10 minutes to assemble. The master part is a six-foot vertical fiberglass hand-wound whip covered with heavy black heat-shrink with a 3/8-24 thread ferrell (double 5/8 wave over 1/4 wave). At the top is a three-foot stainless steel whip that is inserted one inch into the top of the whip. At the bottom is a double U-bolt aircraft aluminum bracket that fits up to a 1-1/2" mast with a 3/8-24/50-239 brass connector for your PL-259. The fourth part consists of three 45-degree aluminum radials, 21" long, attached underneath the bracket with screws. The total height after assembly is 10-1/2 feet.

The model 9209 is priced at \$32.43, and will be sent UPS within the continental U.S.A. for \$4 S & H. For more information, contact A.S.A., P.O. Box 3461, Myrtle Beach SC 29578; (800) 722-2681. Or circle Reader Service No. 204.



PERIPHEX

Periplex has announced its longer operating time, high capacity, lower cost batteries for the Alinco DJ-580 hand-held radio. The EBP-22S (12 volts, 800 mAh) offers a 15% increase in operating time at high power, while the EBP-24S (7.2 volts, 1500 mAh) offers a 200% increase in operating time at low power. Both batteries are 3" tall. They are completely compatible with the Alinco EDC-24 and EDC-34 chargers.

The EBP-22S is \$65 and the EBP-24S is \$62. All battery packs include overcharge and over-temperature protection, short circuit protection, and a one-year warranty. For more information, contact Periplex, Inc., 115-1B Hurley Road, Oxford CT 06478; (203) 264-3985, (800) 634-8132. Or circle Reader Service No. 206.

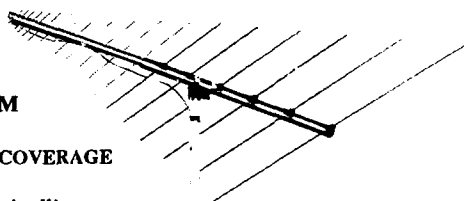


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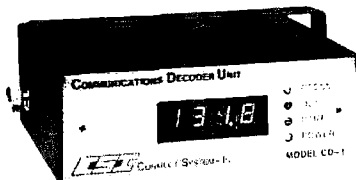
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CIRCLE 12 ON READER SERVICE CARD

NEVER SAY DIE

Continued from page 4

the channel is occupied, just as a phone or CW op would, and then wait for a possible response, which would put the relay on hold, we might be able to avoid much of the QRM which blind transmissions could incur. Indeed, if the relay station did get a response it should be programmed to keep track of the activity on the frequency and sense when it has ended so it can send another query, checking for any possible new interference.

On 20m and higher bands it's normal not to hear both ends of a contact, so an automatic relay station should be able to do more than merely check for any received signals. It should be intelligent enough, via its software, to avoid interfering when only one side of a contact can be heard. Perhaps we need to agree on some protocols to help simplify this problem.

At any rate, I'm glad cooler heads prevailed and that another escalating brouhaha may have been avoided. We need peace, not war within our hobby.

ARRL Caves In

The uproar over the ARRL's proposed ban on automated packet on HF was so furious that the League was forced to back down. Indeed, it got so bad that disgusted packeteers were beginning to talk seriously about forming

their own national society. Well, when an organization gets that far out of step with a large block of the membership, something has to give. And give it did.

A hasty meeting of the ARRL digital committee, plus most of the board of directors and the executive committee, was held during the ARRL National Convention in Los Angeles. Faced with insurrection, they had little choice but to reverse the board of director's July decision. The details of a new proposal which will allow automated packet still have to be agreed upon, but it looks as if the board capitulation may have defused a very nasty situation which could have seriously hurt League membership.

Indeed, packet operators aren't soon going to forget what they interpret as an antagonism to packet on the part of the ARRL's digital committee and the board. Hopefully the directors have learned a lesson and will be twice cautious before again trying to stop packet pioneering and network development.

With packet operation being virtually the only contribution amateur radio has made to communications technology in a generation, we need to give our packeteers every bit of help we can. We'd like to see HF packet develop dependable 9600 baud systems. We'd like to see them design circuits which will give perfect copy through interference, static, fading and so on. None of this is going to come easily.

It is unfortunate that we seem to have so many extremists in our hobby. The cries that unattended HF packet stations will be jamming our HF bands with unintentionally triggered transmissions is as ridiculous as the predictions that the no-code license would turn our bands into CB-like disasters. We seem at times to have an inexhaustible supply of reason-challenged loud mouths.

Packeteers, stick to your guns and make those fogies on the ARRL board stop trying to be clogs in the wheels of progress.

Making Money

A 52-page catalog from Home Automation Labs, 5500 Highlands Parkway, #450A, Smyrna GA 30082-5141, reminded me that I've had a few more surly letters from retired hams worrying about not having enough money. Get off your rocking chairs and get busy. I mentioned recently that \$10 bills are just hanging out there, waiting to be plucked. Well, presuming you're not a total washout as a ham, you should have the technical expertise to help people set up security systems in their homes, offices, warehouses and so on. Plus you can help them automate their homes.

A retired chap near my home put up some notices on the local supermarket bulletin boards announcing he was in business repairing VCRs, TVs and hi-fis. His come-on was a free estimate of

the cost of repair. My wife immediately loaded up the car with a few VCRs and a CD player which had been waiting for me to have time to set up a workshop and then see about fixing 'em. I guess, after year or so of excuses, she figured there might be a better way. Well, this chap, within days of putting out his shingle, is up to here in stuff to fix. His estimate is free. His prices are fair. Plus he brings good old Yankee thrift to the table, getting needed parts from truly defunct VCRs.

If you want to make money all you have to do is look around and see what people need done. It may be handyman work around their homes, feeding their pets while they're on a trip, or you might, as my wife did, find such a need for baby-sitting that you organize a baby-sitting service, hiring dependable women and scheduling for them.

Unless you're a complete zero you must have developed some skills. So where can you market them? You can offer services to smaller companies as a consultant, thereby helping them avoid medical coverage, which often adds around 30% or so to the payroll. Very few companies don't need extra help, it's just that it is so much trouble interviewing people and hiring them that they tend to avoid it. So talk to the boss and find out what problems he has. Then show him how you can help solve his problems for a fraction of what he's losing by letting things go.

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Say, have you got a shirt? Well then you're all set to launch a small ham business of some kind. The shirt is what you'll lose. Every now and then I hear someone sounding off about ham companies getting rich off us hams. When I hear that I know I'm faced with a blowhard fueled by massive ignorance. If you want to sell to hams, figure you're doing it as a hobby and make sure you've got a steady outside job to cover your losses.

I almost got into the ham business back in 1946. I'd designed a fantastic little 2 meter transmitter . . . a pair of miniature tubes with a long lines tank circuit and grid modulation. It worked like a charm, even in the trunk of my car. Bill French W2NYC and I talked with Millen rep John de Blasi about their making it. Millen wasn't interested. I was just out of the Navy after WWII and was going back to college in a few weeks, so we decided it wasn't a good time to start manufacturing rigs. In retrospect, perhaps we should have so we could have shared in the catastrophe that hit the ham industry in 1964 when it was almost totally destroyed by the League. Even the mightiest fell . . . including Millen, National, Hallicrafters, Hammarlund and so on. There were no survivors of any size.

On the other hand, going back to college turned out to be a miserable waste of my time. Two years blown to hell, with nothing really to show for it,

and very little of any value learned. I sure wish there had been someone around to put things into perspective for me.

Well, back to making money. Most of the businessmen I talk with have plenty of jobs open, they just don't know how to find the people they need. I had lunch with a chap who's working on solid prototyping computers. If you're not aware that there are now printers which will make solid objects you haven't been doing your homework. And if you're not keeping up with what's going on in technology, how valuable are you as an employee?

Desktop manufacturing is going to be a whale of a business in a few years, so this is the time to work with a small firm experimenting with prototypes and come up to speed. In a year you should be able to name your price if you get busy and become an expert.

This new field needs a publication to help it grow, but I'm too short of people right now to tackle it.

So tell me again how you're short of money. Tell me about being out of work. Tell me about not being able to afford that new rig.

Starting Education From Scratch

For starters we know our present educational system is failing us. Worse, we know that unless we make some major changes we're going to be sentencing our children and grandchildren

to a second-class quality of life. Either we turn out the educated and skilled workers needed to do high-tech manufacturing or we're going to continue to see our standard of living sliding.

Having done a hellacious amount of research on the situation, my next priority is to put everything I've learned together into one big report. Then I have to see how I can get the changes started.

Since I'm solution-oriented, my report will tend to emphasize proposed changes rather than just citing what's gone wrong. Unless you've been living the life of a mushroom you're well acquainted with how bad things are. And you probably have read, heard or seen on TV reports on how poorly we're educating our children.

My approach to the educational process is to break it down into child development periods. I'm arbitrarily dividing education into eight age groups. I think you'll see the sense of this as we progress. I think you'll agree that we all tend to learn things differently at different ages. We can't deal with a one-year-old kid the same as we do an adolescent. And ditto someone in their twenties vs. someone in their sixties.

Age #1

You're probably expecting me to start with kindergarten. No way. By the time kids are five years old around 80% or so of their life's patterns are already

fairly firmly set. Nope, we've got to start much earlier. Much, much earlier. Hold your chair and don't laugh . . . we're going to start with conception. I think you'll agree that I'll make a very good case for this. So let's assign Age #1 to the nine months between conception and birth. As you'll see, this is a surprisingly active educational period of life.

As you understand more about the importance of this time, you're going to understand why we need to radically change some motherhood behavior during this critical period of life.

Now, before I can help you understand how education takes place during the prenatal months, I have to go back to some fundamentals of all life. I don't want you to have to take my word for the importance of the prenatal period, I want you to understand why this time is so critical. And from that understanding you'll be able to figure out for yourself what changes mothers need to make.

In my October editorial I explained how all living organisms obey the most fundamental of all laws . . . self-preservation. I explained that all life has a stimulus-response mechanism built in which is designed to warn of possible harm. Trees have this and respond to danger by generating chemicals to ward off invasions of insects or to fight off other plants. In humans pain is our warning medium. Pain tells us when

Continued on page 82

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MOSFETS

For the last year or so I have been playing with a remarkable solid-state device: the power MOSFET (MOSFET is short for Metal Oxide Semiconductor Field Effect Transistor). The power MOSFET was introduced by Siliconix, Inc., in 1976. I find what these devices are capable of doing absolutely amazing. More and more of them are finding their way into my QRP projects.

Figure 1 shows a schematic drawing for a power MOSFET. The three main leads to the power MOSFET are: gate, drain and source. Most power MOSFETs are "N" type devices, but there are several different types being made as "P" type devices. Notice the diode connected between the source and the drain leads. This diode is part of the internal workings of the power MOSFET. The internal diode has the same current ratings as the MOSFET.

There are many, many specifications for the power MOSFET, but we need concern ourselves with only four. First, there is the continuous current for the drain, commonly called I(D). The drain current is for a specific junction

temperature and at a specific gate voltage.

The second specification is the gate on resistance, known as RDS(on). This is the resistance the FET shows when it is turned fully on. This resistance is measured between the source and the drain.

Third is the voltage of the MOSFET. As a rule, as you lower the RDS(on) the voltage rating of the MOSFET is also lowered. In other words, a power MOSFET with an RDS(on) of 0.028 ohms may be rated at a voltage of 50 volts. On the other hand, a power MOSFET with an RDS(on) of 0.018 ohms may have a voltage rating of only 30 volts. They make power MOSFETs to handle up to several hundred volts. However, as the voltage increases, so does the RDS(on) resistance. With the higher voltage, you can have an RDS(on) of several ohms.

The RDS(on) resistance is also dependent on the temperature of the MOSFET junction. Most power MOSFETs have a positive temperature cure. As the power MOSFET heats up, the RDS(on) resistance increases. This increases the voltage drop across the device and causes even more heat to be built up.

The fourth specification is input ca-

pacitance. The capacitance varies with the die size of the power MOSFET, but it generally ranges from 30 pF to 3,000 pF. This capacitance must be taken into account when designing amplifiers. The extra capacitance will hold the gate on a bit longer while doing high speed switching. A special driver circuit must be used to ensure proper gate turn-off times.

Using MOSFETs

The power MOSFET makes a perfect high-side switch. Unlike the bipolar transistor with its 0.7-volt drop, a single high-side MOSFET switch can have a resistance of less than 0.010 ohms! You can easily run 30 amps of current through a high-side power MOSFET switch and dissipate only 9 watts. If you run high current like that through a transistor, you'll have a real heat problem on your hands. By adding more power MOSFETs in parallel, you can drop the RDS(on) resistance to extremely low values. I've run 30 amps through several power MOSFETs and have a calculated loss of only 2 watts!

To use a power MOSFET as a high-side switch, you will need to build a voltage pump or some other type of gate driver. A voltage higher than the voltage being switched is needed to turn the MOSFET on for high-side switching. In a typical 12-volt system, a gate voltage of +20 volts will be required. Most MOSFETs have a limit as to the maximum voltage applied to the gate. This is normally +20 volts maxi-

mum. Voltage higher than this may cause the insulator surrounding the gate to be pierced, destroying the MOSFET. This is known as the breakdown voltage.

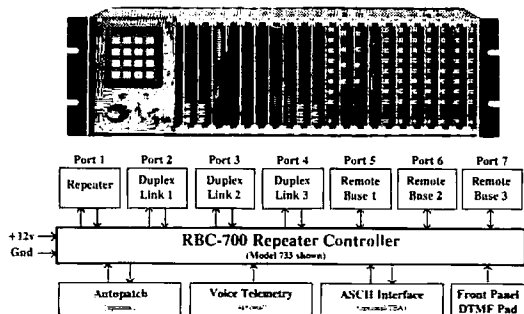
A voltage pump can be as simple as an oscillator and a voltage multiplier circuit. There are several different types of MOSFET gate drivers available. These are little more than a voltage pump and associated control circuitry, all contained in a single 8-pin DIP IC. Right now, these ICs are somewhat expensive and hard to obtain. Figure 2 shows a simple voltage pump. Notice that it consists of a single CMOS IC and some diodes. Two stages of the IC are configured as an oscillator. With the values shown, the oscillator runs at about 300 kHz. When the control line is pulled low, the output of the oscillator is coupled to the two 0.01 capacitors and then into the voltage multiplier. The output is about +22 volts. This voltage pump works up to several kHz. It's a bit slow to turn off and therefore may add some distortion to the output if you try to switch it off and on at a rate of over 20 kHz.

A zener diode on the output of the voltage pump will protect the MOSFET's gate from over-voltage. This is but one version of a voltage pump. I've used just about every configuration with just about every IC known and have always come up with something that works. A 555 timer in a stable mode makes a great voltage pump.

You can parallel-power MOSFETs

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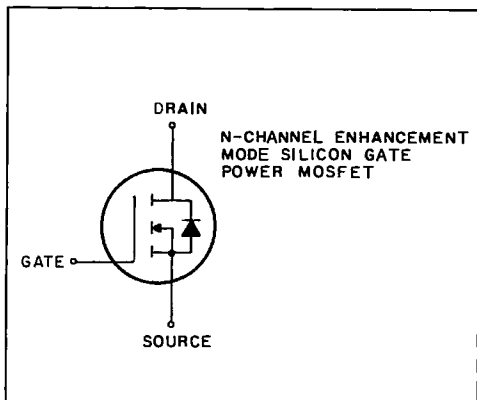


Figure 1. Schematic drawing for a power MOSFET.

without too much trouble. You don't need to worry about picking out a "matched pair" as you do with transistors.

In theory, a perfect switch would have zero resistance when on and infinite resistance when off. A power MOSFET comes very close to a perfect switch. And indeed, a power MOSFET makes a very good switch. Power MOSFETs are used in a variety of switching applications, mainly in switching power supplies. The new compact fluorescent lights use high voltage power MOSFETs instead of a magnetic core ballast.

A power MOSFET is a voltage-controlled device unlike the transistor, which is a current-controlled device. The drive requirement for a power MOSFET is easy to obtain. For simple switching circuits, a gate voltage of +10 volts will turn the MOSFET fully on. One of the best traits of the power MOSFET is the ability to be rapidly switched on and off. This makes the power MOSFET a very good candidate for RF switching and amplification. A power MOSFET amplifier can be operated in Class A, AB, B or C. The power MOSFET is particularly immune to high SWR damage.

If all of this is true, then why have we seen so little about the power MOSFET? Well, price is one thing that has kept them from use. However, the price of single-lot power MOSFETs has fallen to the point where you can now buy them for under two dollars. For MOSFETs with a really low RDS(on), the price is still a favorable \$4-\$5 each.

For use in RF applications, most power MOSFETs like to see a source voltage of +28 volts. While it takes no more effort to build a 28-volt supply than to build a 12-volt one, a 28-volt transceiver is much harder to operate in the field on batteries. When used with a commercial power line, that restriction does not apply. In fact, many of the newer transceivers today use high voltage (+28 volts) power MOSFETs in the power amplifier stages. The higher supply voltage gives them a better efficiency and a cleaner output than a bipolar transistor. Japan Radio has recently placed on the market a 1 kW solid-state amplifier using high voltage power MOSFETs running with a +60-volt supply. The higher voltage

also allows the designer to use a smaller power supply. It's much easier to generate +60 volts at 50 amps than +12 volts at 250 amps.

Because the power MOSFET is a high impedance device, it can become unstable when used in certain designs, and God knows, I've fried many a power MOSFET in my workshop. I've blown the tops right off the case, leaving only the leads left soldered to the PC board.

They will oscillate on their own for no apparent reason. Even when used as a switch, the wiring to and from the power MOSFET as well as the layout of the PC board must be taken into account. One designer I know who is working on a high power (2 kW) sine wave inverter told me to add ferrite beads to the gates of each power MOSFET to keep them tame. Lay out your circuit for a power MOSFET just as you would any RF device, even if you're not using the MOSFET in an RF application. This includes good grounding and plenty of bypassing, especially on the gate lead. All leads must be as short as possible. No clip leads are to be used here.

What's Available?

Here are some typical power MOSFETs you can buy. The IRF511 is available from Radio Shack. It goes for about \$2 and has an RDS(on) of 0.5 ohms at 4 amps of drain current. It's not a real "hot" MOSFET as they go, but you'll find it hanging on the pegs at the local "shack." For a much better device, use an IRF531. This MOSFET is about 10 times better than the 511 and has an RDS(on) of about 0.05 ohms at a drain current of 15 amps. Both the 511 and the 532 come in a standard TO-220 case style.

For even more current and a lower RDS(on), try the IRFZ30 and the IRFZ42. These MOSFETs have a drain current of over 50 amps! The RDS(on) is a scant 0.028 ohms. Although much harder to find, the Siliconix SMP60N06 has a drain current of 50 amps and a RDS(on) of only 0.018 ohms. Siliconix also makes a 30-volt MOSFET with an RDS(on) of 0.010 ohms. That's 10 milliohms of resis-

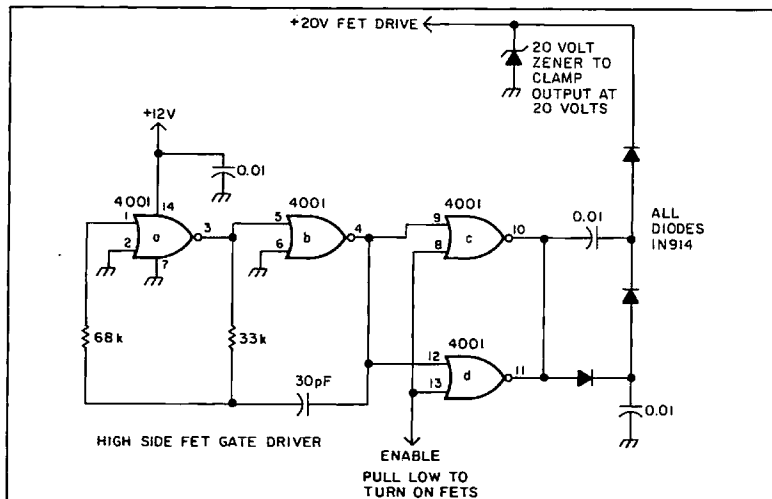


Figure 2. Simple voltage pump for a high side FET gate driver.

tance! Again, these devices come in the standard TO-220 case. You can find these MOSFETs listed in both the Digi-Key catalog and the Mouser Electronics catalog. Neither company carries the Siliconix devices.

Because the TO-220 case is electrically hot, when mounting the MOSFET to a heat sink you must insulate the device from the heat sink. You can use any of the TO-220 mounting kits on the market. Radio Shack sells one for under a buck.

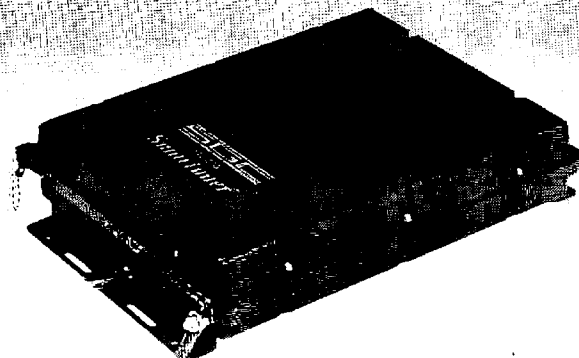
I have found that even though the

device may be rated at 50 amps of drain current, getting that much current in and out can be a real engineering task. It's better to use two or more MOSFETs in parallel to split up the current instead of using one MOSFET.

Next month I'll have some circuits using power MOSFETs. Also, in the coming months I'll show you how to build a solar charge controller using pulse width modulation by way of power MOSFETs. Stay tuned—there's a lot of good stuff coming up here in the "QRP" column.

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The Last Micro

Hi, folks. I think we're finally ready to wrap up our Micro Power mini-series. We've covered what micros are, how they work and what can go wrong. Let's look at some of the other circuits sometimes used with microprocessors and microcontrollers, and at the problems they can cause.

Reach Out and Scan Someone

Some rigs just have too many buttons and switches for one chip to read them all! This can be true even when the switches are multiplexed. In such big radios, input/output (I/O) expander chips are used. These are nothing more than data selectors or multiplexers. In this case, though, the term "multiplex" has a slightly different meaning than it does when applied to switches. What these chips do is place the binary value of some of their input pins onto their output pins, with the computer selecting which input pins are to be examined. For instance, there may be 16 input pins and four output pins. By sending a code to the multiplexer chip, the computer can check all the input pins in groups of four.

Another technique sometimes used is data encoding. Here, the 16 input pins are simply converted into a four-bit word. (Remember, four bits can specify 16 different states.) The computer simply decodes the four bits to determine which button was pressed. The disadvantage of this system is that it can only tell if any one button

has been pressed. Multiple presses will cause an erroneous code. That is, unless the buttons are scanned first, as I described a couple of columns back.

No Response

If the radio won't respond to a button press, there are some clues to look for before you dig in with the scope. First, is it just one button that won't work? If all the others work, I'd suspect the switch itself. Check the voltage on both sides of it. If you see a pulse, then you know it's a multiplexed (scanned) switch. The pulse should appear constant on one side of the switch and come and go on the other side when you press the button. If you can't find the pulse on the

Getting Lost

If the switch is working, the signal must be getting lost somewhere on its journey to the micro. Unfortunately, that journey may be quite convoluted! If the I/O system is scanned, chip by chip, by the micro, the button press may be turned into no more than a tiny blip before entering the bitstream. It can be mighty hard to separate the blip you want from all the other blips because everything is traveling on a common buss, just like in any computer system. Really, it can be next to impossible without a logic analyzer, or at least a dual-trace scope and a lot of luck.

A bad I/O chip is much more likely than a bad micro. Try this: Trace the switch back to the I/O chip. Now find the "chip select" pin. There should be a pulse on it. Trigger your scope on that pulse and then check the output pins, one by one, while you press and let go of the button. If you find an output pin with a pulse appearing or dis-

and there's no pulse, suspect the other chip, because it isn't driving the I/O chip. Of course, it may not be getting the signals it needs. Now you can see why it can be so maddeningly difficult to mess with any but the smallest digital systems. You can spend an awful lot of time going down blind alleys and buying chips you don't need.

Going Out

The same I/O techniques are used for LED annunciators and some other output signals, including those which actually control various parts of the radio. Remember, when you select the operating mode (AM, SSB, etc.), IF filter, etc., you are really telling the micro to select them. It interprets your request and sends all kinds of signals to various circuits in the rig. For instance, when you change bands, not only does the frequency synthesizer get set, but the various bandpass filter relays get set, too. Ever notice that tuning through certain frequencies causes a mechanical click from the radio's interior? That's a bandpass filter relay being tripped.

I/O failures can cause all kinds of strange symptoms. For instance, if transmit output power or receive sensitivity is way down only on a certain band, check that the bandpass filter relay is being set, and that the relay contacts are working. Also, many functions are switched with diodes, and a bad diode can make it look as if the I/O system isn't working properly.

In general, I/O failures are more common on the output side than the input side because many outputs are driving things, such as LEDs, which require substantial current. Some radios use buffer transistors to protect the chips, but many don't, and those can stress the chips to the burnout point.

Memories...

ROM and RAM can fail. When they

"Some rigs just have too many buttons and switches for one chip to read them all!"

other side, the switch is not making contact. In particular, that can happen with flat membrane switches, particularly if they've been exposed to bad environmental conditions such as liquids or prolonged cigarette smoke. If the switch is bad, you may be able to peel it apart and clean it if you're careful.

If you get DC on one side of the switch and nothing on the other side, try scoping the DC side while you press the button. If it goes to zero, the switch is working. If it doesn't, check the other side. If it rises, again, the switch is working. If there's no change, the switch is *not* working.

appearing when you press the switch, the I/O chip is good. If you can't find any change, the chip probably is bad. There's no easy way to be absolutely sure, short of trying a new chip. Luckily, many radios use standard I/O chips you can get from American companies. Some, of course, don't.

By the way, if there is no pulse on the chip select pin, check the schematic to see if that pin is tied high or low. In some simple systems it can be, particularly if there's only one I/O chip to begin with. Most likely, though, there are several chips being scanned. If the chip select pin is connected to the output of another chip,

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do, the micro essentially has a case of Alzheimer's disease, and it acts accordingly. It may do strange things, such as write garbage to the display or refuse to tune properly. Usually, though, it'll just crash altogether and become non-responsive.

If the failed memory is inside the micro, the chip must be replaced. If the memory is external, you're in better shape because memory chips usually are a lot cheaper than micros. At least, RAMs are. ROMs are another story because they contain the manufacturer's operating program. Although the chip may only be worth five bucks, you may pay \$50 or more for a new one. You're paying for the software, not the IC!

Memories can fail in three ways. First, the chip can die completely, with all of its outputs stuck either high or low. This is the most common type of failure, and the stuck outputs can pull down (or up) the entire buss, making it very hard to find the guilty chip without pulling them, one at a time. In the case of soldered-in chips (which most are), the likely damage to the PC board from removing all those chips is so severe that you would be foolish to try it.

Another failure mode causes just one of the chip's output lines to get stuck. That will cause one of the buss's lines to get stuck. If you see activity on all the buss's lines except one, suspect this kind of failure. Try

disconnecting from the board the suspect pin of each chip, one by one. Be sure to reconnect them after each try so that only one is disconnected at a time. Of course, the computer won't work properly in that state, but if the stuck buss line starts showing pulses again, you've found the bad chip.

The weirdest failure mode occurs when only one memory cell goes bad. In that state, everything continues to work, but it just doesn't work. Data gets scrambled and the computer mal-

of cooling spray will really help here. By the way, there now are ozone-friendly cooling sprays available. I have a can, and it is odd stuff. It works pretty well, but it is very heavy and it literally "falls" out of the can! It looks quite strange when you spray it. Also, it tends to ruin plastic, so keep it away from the outside of the radio.

If you have a thermal problem, spraying the chip will not directly return the computer to operation the way it would in an analog system. By the

works fine for a while, then it goes nuts! The display gets weird and the rig won't work. If I turn it off and on again, it works for a while, then it does the same thing. Clearing all the memories has the same effect. Any ideas?

**Signed,
Scrambled**

Dear Scrambled,

This is very appropriate to our current topic. Your rig's computer is getting trashed. This one's easy, though. If you remove the unit holding the speaker, you'll see a sealed metal box. Unscrew the cover and you'll see the "Digital-A" board. On it, there's one socketed IC, and that's the ROM which contains the rig's operating program. Early '940s often had this problem, and the solution is to pull the IC and put it back in, being sure to press it in all the way. (Be careful not to reverse the chip, of course!) Apparently, the heating and cooling cycle makes the chip work its way out of the socket over a long period of time. (My old Apple II+ had the same problem!) Later '940s had a wire soldered to the ground pin of the IC, and even later ones had no socket at all. I suspect yours is an older one, though, or this wouldn't be happening.

Well, I think that about covers the micros so, next month, we'll get into something new. See you then. 73 de KB1UM.

"Remember, most thermal problems are caused by bad connections, not bad chips."

functions. The problem may be as subtle as a wrong display digit or indicator light, or it may shut the computer down altogether! Trust me, you won't find this problem. If you suspect it, go find the shipping box. Luckily, this kind of failure is pretty rare. I've seen only two memory chips do it.

All Hot Up

These failure modes can be thermal, too. Generally, a chip with all lines stuck is dead and will *not* be thermal. But a single line can be working when the chip is cool and then quit when things warm up. A single bad memory cell can do the same. A can

time you spray the part, the computer's program is off in never-never land. The cure is to spray the chip and then turn the radio off and back on. If there's a reset button, that should do it, too. Remember, most thermal problems are caused by bad connections, not bad chips. Even if spraying a chip fixes the problem, check the connections to the board before replacing the part. Even if they look OK, try resoldering them. You never know, you just might save the cost of a new IC!

Now, let's look at a letter:

Dear Kaboom,
My TS-940 has an odd problem. It



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Simulated Circuits—DSP High Tech in Your Shack

As most of you already know, one of the major components of a TNC or multimode controller is a modem. "Modem" is a compound of the beginnings of the words MODulate and DEModulate. It is the modem's job to turn digital signals—which consist of simple "on" or "off" information, unsuitable for transmission on an audio channel—into analog signals which are suited to audio transmission. Normally, the modem does its job with the help of analog filters. These are tuned circuits that react to the presence of the tones used by some particular communications standard. For example, packet radio running at 300 baud on HF uses tones at 2110 Hz and 2310 Hz to transmit data. So, to receive 300 baud HF packet, a modem needs filters at these frequencies. Keep in mind that this is meant to be a simple example to get the point across: As the data rate increases, the complexity of the modulation scheme follows, using other aspects of the signal, like its phase. The example given is called "FSK" for Frequency Shift Keying.

The idea is this: Until recently, if you wanted to receive a particular mode, you needed a modem specific to that mode, made of analog parts and somehow connected to your controller. While you still need a modem designed for each mode's unique properties, it no longer needs to be made of capacitors and resistors. How is this possible? Thanks to a technology—not new, though only recently affordable—called DSP (Digital Signal Processing). DSP is an application of computer technology that lets a hardware engineer design and implement an analog circuit in software. That circuit is a simulation of the discrete (individual analog component) version that functions precisely as if it were a normal analog circuit. This approach brings a number of advantages, with two being of particular interest to the ham.

Performance

Within their operational limits, digital filters can provide much better performance than analog versions. One of the reasons is the ability to precisely tune the behavior of the particular filter, even to the point of having it change characteristics to best suit the current situation. Digital filters can be created with characteristics unavailable in analog designs—such as the brick wall filter you will find in your CD player. This

filter is designed to completely eliminate any output above 20 kHz, and the digital version can have a very steep cutoff not possible in an analog implementation.

Flexibility

This is the part that will be near and dear to the hearts of those of you who have gone from RTTY to AMTOR to 1200 baud packet to 2400 baud packet—you get the idea—buying a new box for each mode. A DSP-based multimode controller just doesn't become obsolete—at least not for a long time. Why? Because the modems—those pesky parts that are different for each mode—aren't real, they're simulated by the DSP chip. This means

eliminate multiple interfering carriers with very narrow notch filters, built on-the-fly by the filter box itself—no tuning or adjustment. Imagine being able to have SSB QSOs on 40 meters again, at night! If this sounds like magic, well it is a sort of computer technology magic, but it works. This problem is ideal for DSP because of the nature of the interfering signal—steady and constant. What about problems with interfering impulse (ignition), or white noise, that don't share this convenient obviousness?

DSP can help here, too. The technique is just the inverse. Get this: The DSP filter listens to the signal, identifies the human speech by its characteristic properties (speech is not highly correlated like a carrier, but it does have specific qualities that separate it from noise and other signals), and builds a bandpass filter—again on-the-fly—that fits the speech. The effect is to filter out the surrounding signals that are interfer-

***"Within their operational limits,
digital filters can provide much
better performance than
analog versions."***

that a DSP-based unit only needs new software to operate in the latest and greatest mode. Finally, you can buy one box and stop.

Of course, modems are not the only use for filters in the ham shack. AF (Audio Frequency) and RF (Radio Frequency) filters that tailor the signal heard from an HF receiver are also vital to good operations, particularly on crowded bands populated with rogue broadcast stations—like 40 meters—or stations whose entire ham radio interest (it seems) is tuning up on top of other QSOs—commonplace on 20 meters. Traditional analog filters can help with these problems, but the limitations real world filter circuits place on them makes them far from ideal. For example, a good analog notch filter can eliminate much of a single interfering carrier—like the heterodyne from a broadcast transmitter, or a station tuning up—but they are difficult to tune and can only deal with a single interfering signal at a time. Enter DSP, perfectly suited to this problem. With a relatively simple DSP filter it is possible to adaptively (that is, on-the-fly) notch out interfering signals—automatically!

This is possible because of the highly correlated nature of a heterodyne type interfering signal. In other words, the signal is constant and regular—completely unlike the human speech that is carried by the desired signal. A DSP-based notch filter can automatically identify and

ing. The results of this process are not quite as miraculous as the notch filter but it works, dropping the noise by as much as 20 dB. There are some limitations to this technique, and it won't take a signal from the mud and make it louder than the S9+20 noise from the dirty power line insulator down the block. On the other hand, it certainly will reduce the user fatigue caused by listening to the noise surrounding the signal you want, and make QSOs on the HF bands less headache-producing.

What You Can Buy

Thanks to the general availability of low cost DSP chips, several manufacturers now offer DSP-based ham radio gear. These products fall into the two categories discussed above—multimode controllers and adaptive filters. Here's a list (fairly complete, but certainly missing a few) of what you can order today to get on the DSP bandwagon, and maybe reduce some of those heterodyne headaches.

Multi-Mode Controllers

DSP-1232 and DSP-2232
AEA (206) 774-5554
List Price:
DSP-1232 \$789
DSP-2232 \$999

The DSP-x232 series of data controllers from AEA are available now through dealers. The difference between the two units is in the number

of radio ports—one for the 1232 and two for the 2232. The DSP-x232 is based on the Motorola DSP56001 DSP chip, paired with a Zilog Z-180—which does the general purpose computing. The currently-shipping version of the DSP-x232 offers 10 modem programs for the DSP56001 stored in ROM:

- 300 baud HF packet
- 1200 baud VHF packet
- 2400 bps packet
- 1200 bps BPSK packet (satellite)
- HF RTTY
- Morse
- Facsimile
- FM SSTV
- 9600 bps (K9NG compatible)
- 1200/4800 bps ASCII (Satellite)

and dual port operation (DSP-2232) for 300/1200 or 1200/1200 baud packet, and RTTY-AMTOR/1200 baud packet combinations. There is 32K of DSP RAM which can be used to download additional modems into the unit. These future modems will be delivered by AEA on diskette, or be made available for downloading from a BBS.

DSP-12
L.L. Grace Communications
Products
41 Acadia Dr.
Voorhees NJ 08043
(609) 751-1018
List Price: \$695
RAM Expansion: \$99
A-to-D, D-to-A option: \$49

The DSP-12 from L.L. Grace is ideal for the experimenter. Along with its DSP56001 DSP chip, it sports a V40 (PC-compatible) processor on board. This means that programs for the box can be written in readily available PC-based languages with all of their associated development tools. With the 1 megabyte RAM upgrade option, the DSP-12 could be made into a stand-alone packet station with a sophisticated terminal program built-in, or a special-purpose communications device. Also available for the DSP-12 is an eight-channel A-to-D and DAC option which allows for all sorts of possibilities—including telemetry, voice recording and playback, and any other analog application that the experimenter can think of.

Out of the box, the DSP-12 works as a multimode controller, and provides modems for a variety of modes, including advanced satellite operations, in addition to the standard HF and VHF packet and RTTY modes.

DSP-based Filters

NF-60 DSP Notch Filter
JPS Communications
P.O. Box 97757
Raleigh NC 27624
(800) 533-3819, (919) 790-1048
List Price: \$149.95

The NF-60 from JSP is a DSP-based notch filter that automatically

The Down East Microwave

DEM 432K

Continued from page 36

output peaking can be had by adding or removing a turn from L4 and L5. I found in several cases that coils on all boards required at least one-turn modifications either way, but all of these updates are now in the manual.

By connecting your low-level (1 to 3 milliwatt) signal at 28 MHz to the T70, you should be able to measure 40 to 60 milliwatts of energy at 432 MHz with your millivolt/wattmeter. Otherwise, just connect a dummy load or antenna and listen on a 432 MHz receiver for your signal! To verify that the receive converter is working, connect its output to your 28 MHz receiver and use a weak-signal source at 432 MHz. You can also use a handie-talkie several feet away to run this test.

If all has gone smoothly, you've got the basic building blocks of your linear transverter up and running. The next step is to build up the 432PAK amplifier kit. Although you won't need to install the LO/T70/R70 boards in any kind of case yet, you should build the power amplifier right into its chassis before testing it. The PAC-TEC enclosure works perfectly, measuring 4-1/2" long x 2-1/2" wide and 1" deep. Make sure you don't bend the leads more than you have to when soldering the power module to the board.

My approach was to drill and secure the board to the box first, then install the power module (with a bit of silicon grease) to the box with the leads straddling the PC board. (See Photos A & B.) This works very well, offers excellent heatsink capacity and is quite strong. I used 1000 pF feedthroughs to bring bias and operating voltage into the box, while the RF in and out connections are direct-wired with miniature coax.

Once the PA kit is complete, you can test it by applying 13.8 volts to both pins and connecting a wattmeter and dummy load to the output. Connect the T70 board's output to the 432PAK input and apply drive from your 28 MHz source. You should see anything from 12 to 20 watts, depending on drive level. There are no adjustments to make after this.

Packaging

The three boards were designed by Rick Campbell KK7B to be stacked as close as 1/4" from each other. This is a godsend as a space-saving technique, and you can fit all three into the larger PAC-TEC box (8-7/8" long x 5-7/8" wide x 2" deep) with a half-inch to spare. My suggestion is to mount the R70 board on the bottom, followed by the T70 board and then the local oscillator on top. Now you'll want to think about some kind of T/R switching. Although Down East offers their SHF PINK pin-diode switch kit, I decided to use the extra LO pads and a small Radio Shack relay (275-249) to do the trick. Make sure you connect a spike protection diode backwards across the relay—anything will work; I used a 1N4004 as I had a junk box full of them. Photo B shows the detail of the pad up close, as well as a small preamplifier I added to the box. The preamp comes from Steve Kostro N2CEI and uses an Avantek ATF20135 device to develop about 14 dB gain with a noise figure better than 0.5 dB. Photo C shows the finished unit with the cover off. I used chassis-mount SO-239 connectors for the 28 MHz IN/OUT ports, and BNC connectors for receive and transmit connections at 432 MHz. They're spaced to be connected to a Dow-Key DK77 relay, available with 12-volt coils for about \$15 each at flea markets. You can select any spacing you want, and you can also use Tohtsu relays which are sold by Down East to provide a single T/R connection. Simply move the PA compartment down in the box and the relay will just fit on top.

You'll also note the small LED, switch, and RCA connector. The switch is used to go from receive to transmit, and parallels a line to the 5-pin power connector. I can key the unit either from my TS430S, or manually when using a 28MHz radio with no external keying. The LED indicates the transmit mode is active, and 12 volts is sent to the RCA jack in transmit to control a small relay. You could also incorporate a simple RF-shifting TR switch if preferred to hard-wire control.

Performance

I finished the entire kit and all chassis work you see here in two evenings, just in time for the 1992 ARRL UHF Contest. I used an out-board 100 watt solid-state amplifier and a single 21-element yagi to work about 25 stations from Richmond, Virginia, all the way up to New Hampshire. The DEM 432K provided adequate sensitivity, using a Kenwood TS-430S as the 10 meter exciter/receiver. Audio quality reports were excellent, and a small "FMing" problem was quickly fixed when I retweaked the crystal to a more stable position. Actual displayed frequency was within 1 kHz of my true location in the band when the crystal was set to peak output.

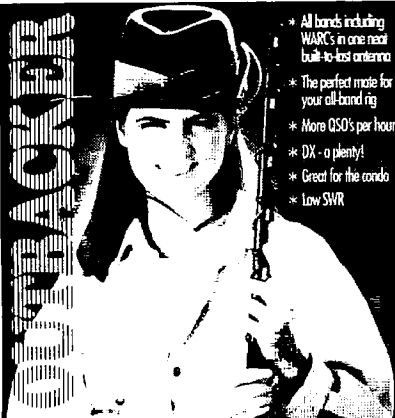
The DEM 432K heard signals (on the average) about 6 dB better than my Yaesu FT-790II transceiver without an external preamp. Plus, I measured greater than 0.15 μ V sensitivity for 10 dB S/N on the bench, using an HP 608F signal generator. More importantly, the DEM 432K shows excellent linearity on the receive side, with a 1 dB compression point (without preamp) in excess of 0 dBm—a lot of signal!

Conclusions

The DEM 432K represents an excellent value for the money. The kit is fairly easy to build if you use care in soldering and keeping track of the chip components. It gives you a complete 70 cm station, using your HF radio as an exciter, and all you'll need is an antenna and some coax to get up and running on SSB, CW, Packet, FM, and satellite operation.

The complete kit of three PC boards and a crystal sells for \$155, while the add-on PA kit without enclosure comes in at \$75, with the enclosure \$135. The 432 MHz preamp kit sells for \$30 without an enclosure, and you won't need the enclosure if it's mounted as shown. Assembled units are also available.

The PAC-TEC enclosures are available through a variety of distributors and retail for about \$18 (#692-900) and \$6 (#351-900). If you visit a few flea markets, you should be able to put a complete unit together for under \$300.



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Loose Ends

I don't know about you, but the morning after a party I always find myself shuffling through the house, trying to clean up and put away loose ends. As the new year opens, I feel much the same way about the column this month.

To begin with, a correction. Somehow, the drawing for the VIC-20 I/O connector shown in the November issue of "RTTY Loop" got scrambled. The correct figure is shown here as Figure 1. It is important to note that, according to the information I was sent, there is no "G" or "I" terminal. This makes the pinouts different from the re-drawn illustration in November's magazine.

Next, a "thank you" to the readers of this column for coming to the aid of Charlie Anderson KG5SX. In July I related his tale of woe regarding a fried Hamsoft cartridge. In a letter just received, Charlie tells of several offers to extricate him from his situation, ranging from burning a new EPROM to helping with a whole new unit.

Charlie is now set for digital, and thanks the readers of 73 Magazine and "RTTY Loop" for the help. So do I!

New Problems to Solve

I received a letter from Ralph Brown of Buffalo Grove, Illinois, looking for some guidance in setting up a RTTY receiving station. Not a ham (yet), Ralph has a Panasonic RF-2200 receiver, a HAL ST-5000 terminal unit, and a Model 28 KSR teleprinter, with gear sets for 100, 75, and 60 wpm. In addition, he has an Autek QF-1A SSB/CW/AM filter which, I believe, is an audio band-pass filter.

Well, Ralph, Figure 2 shows you the basic way to hook up your equipment. I have left the Autek filter out of the RTTY circuit, as the ST-5000 has internal filtering sufficient to deal with the audio output of the receiver. To follow the data path, start at the receiver. Audio from the receiver is routed first to the ST-5000, then to the speaker. You can do this in parallel, and a switch to cut off the speaker, so as not to annoy you with the "tweedle-dee," is a fine idea.

The loop supply goes, as you have indicated in your letter, to the loop input of the Model 28. If you have an oscilloscope, connect the horizontal and vertical inputs to the SCOPE Mark and Space connectors, and the ground of both inputs to the SCOPE Gnd connector, to see the common RTTY tuning cross pattern.

Now, with a mark signal tuned in, the machine should be quiet and just

humming along. We can call this idling. With a space signal tuned in, the machine will be making all kinds of noise but printing nothing. This is running open.

Find a signal which sounds like a RTTY signal. This is characterized by a rapid frequency shift between the mark and space frequencies. After you've heard a few of these you'll get to recognize the sound; don't worry. Tune your receiver so that the signal strength is at a maximum on the S-meter, then adjust the beat frequency oscillator (BFO) so that the mark and space frequency pulses are detected by the demodulator.

If all is well, and the signal is Baudot, you should be receiving at this point. You say, "If the signal is Baudot? Say, what?" Well, here's the rub: Most commercial news services to-day regard Baudot encoding as as outmoded as spark. Unfortunately,

VIC-20 USER I/O PORT

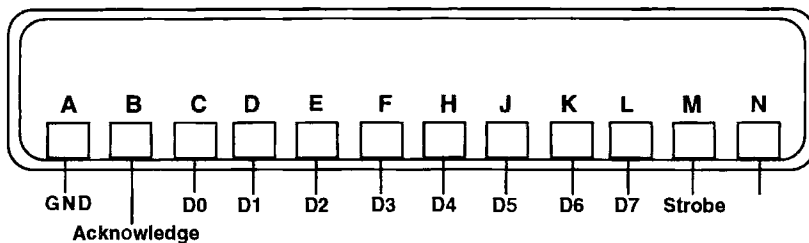


Figure 1. Corrected diagram (see last month's column) showing the Commodore VIC-20 user I/O port.



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the Model 28 teleprinter, upon which your system is based, is essentially locked into Baudot. More modern codes and code systems—ASCII, Sitor, and others—are foreign tongues to your machine. Yes, you can arrange a translation scheme to use the Model 28. Years ago, before the advent of cheap ASCII printers, such schemes were common, with codons such as ".LT." used to represent " ". Whew! Can you imagine a program listing printed that way? No thanks!

So, even if you can get this setup on the air, I am afraid you will be pretty much limited to ham transmissions and the rare commercial station still using five-level code. Several years ago we published a listing of commercial stations still on Baudot; I'm afraid it's hopelessly outdated now. I would be game to hear from any or all of you with information on recently heard Baudot stations.

Speaking of different modes of communication, e-mail received via CompuServe from Michael J. Golbey, M.D., VE7BLD, of Kelowna, British Columbia, addresses his AEA-FAX demodulator. He is wondering if anyone has any experience using the hardware for decoding any other forms of digital communications? For example, it is easy to "see" CW in the monitor mode. It should be possible to write software to display CW, RTTY, etc. Any suggestions would be much appreciated.

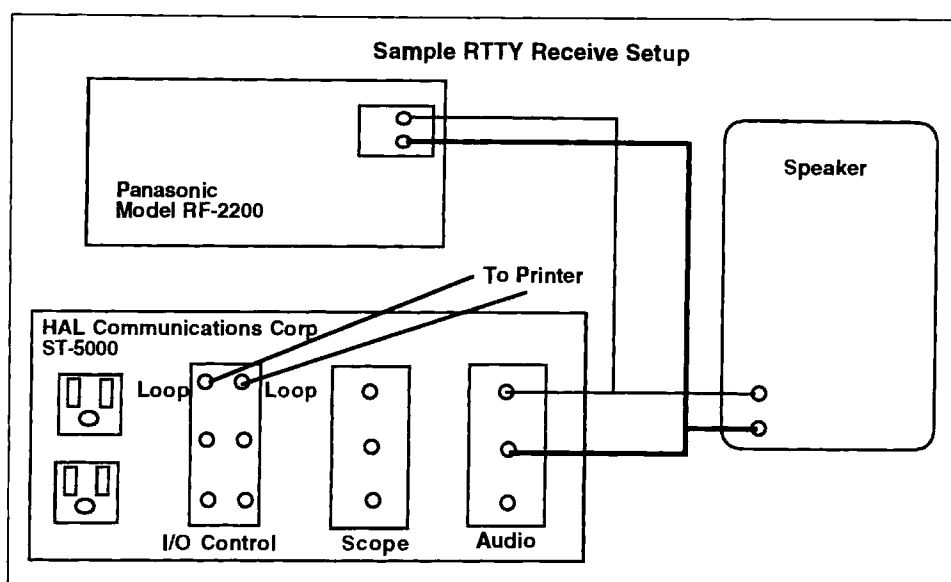


Figure 2. Suggested hookup for a RTTY receive system using a HAL ST-5000 and a Panasonic RF-2200 receiver (rear view connections shown).

Well, Mike, you got me! Let's wait and see what the folks out there say.

Such a way to begin a new year! Overall, I just can't wait to see what the mail brings this month. As always, feel free to drop me a note or e-mail at the above address, or on CompuServe (ppn 75036,2501).

Delphi (username MarcWA3AJR), or America Online (screen name MarcWA3AJR). Of course, the disks remain available, both the "RTTY Loop" Software collection, and the archiving collection detailed last month. Just send disks, either 5 or 3+ inch, high or low density, a stamped disk mailer to return the disks to you,

and \$2 per disk to be filled. Each collection is over one megabyte in size, so be sure to include sufficient media for what you asked for, otherwise I will just pick and choose. Happy New Year everybody. May it be one of health, peace, and well being for each of us, our families, our nations, and the people of the world.

73

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SPECIAL EVENTS

Ham Doings Around the World

JAN 4

CHATTANOOGA, TN WCARS/VEC Exams will be held at Walker County (GA) Civic Center, US Hwy 27, Rock Springs, GA, at 7 PM. Contact **Alan Painter** WA4QCH, 234 Wallaceville Rd., Rossville GA 30741; Tel. (404) 866-1200. Alternate Contact: **Dale Harwood** N4VFF, Rt.4 Box 297-B Hwy. 41 N, Ringgold GA 30732; Tel. (404) 937-5680. Walk-ins normally accepted.

JAN 9

AUGUSTA, GA VE Exams will be sponsored by Western Carolina ARS/VEC at Daniel Fields Airport General Aviation Office. Code tests at 10 AM, written elements at 11 AM. Contact **Jim Abercrombie** N4JA, 2360 Travis Pines Rd., Augusta GA 30906; Tel. (404) 790-7802. Walk-ins normally accepted.

GREENVILLE, SC WCARS/VEC Exams will be held at 8:30 AM at O'Neal Engineering Bldg., 850 S. Pleasantburg Dr. Contact **John E. Chism** ND4N, 203 Lanewood Dr., Greenville SC 29607; Tel. (803) 288-0136. Walk-ins normally accepted.

MIDDLESBORO, KY WCARS/VEC sponsored VE Exams will be held at 10 AM at the Middlesboro City Library. Contact **Andrew A. Pitt** WB8WEZ, P.O. Box 2164, Middlesboro KY 40965; Tel. (606) 248-0046. Alternate Contact: **James E. Dyke**

KZ8A, RR 1 Box 295 AA, Cumberland Gap TN 37724; Tel. (615) 869-4453. Walk-ins normally accepted.

MORRISTOWN, TN WCARS/VEC Exams will be held at 7:30 PM at the Red Cross Bldg. Contact **Roy Zeigler** KF4CB, 2261 Warren Dr., Morristown TN 37814. Alternate Contact: **D.C. Gluck** WD4FOX, P.O. Box 335, Talbott TN 37877; Tel. (615) 586-2041.

WEST MEMPHIS, AR The WCARS/VEC will conduct VE Exams at the Rosewood United Methodist Church, 2303 E. Barton Ave., at 9 AM. Contact **Gene Bagley** AB5BL, Rt.1 - Box 13, Dunhill Rd. N, Marion AR 72364; Tel. (501) 739-4029. Alternate Contact: **Rev. Richard Gregory** AB5CH, 824 Pryor Dr., West Memphis AR 72301; Tel. (501) 735-4060. Walk-ins normally accepted.

JAN 10

JASPER, TN WCARS/VEC Exams will be held at the Jasper Public Library at 1 PM. Pre-registration preferred. Mail Form 610, copy of any license, copy of any CSCE, and check for exam fee (made payable to WCARS/VEC) to contact person. If no one pre-registers, the session will be cancelled. Contact **Charles Woolen** KD4XX, 103 W. 7th St., Jasper TN 37347; Tel. (615) 942-5116. Alternate Contact: **Wallace S. Brown** KD4XV, 409 Magnolia Ave., Jasper TN 37347; Tel. (615) 942-2836.

JAN 11

ATHENS, TN WCARS/VEC Exams will be held at 8 PM at the Athens Municipal Building, Council Chambers. Contact **Evan Ray** WA4PNI, 529 N. Washington Ave., Elowah TN 37331; Tel. (615) 263-9300. Walk-ins normally accepted.

JAN 16

CAMERON, MO The Missouri Valley ARC, Green-Hills ARC, and Ray-Clay ARC, will co-sponsor the 3rd annual Northwest Missouri Winter Hamfest from 9 AM-4 PM at the KMRN Tri-Rivers Expo Hall on US 69, one mile north of I-35 exit 48 (Wallace State Park exit). FCC Exams. Indoor Flea Market. Free Parking. Tickets \$2 in advance or 3/\$5; \$3 at the door or 2/\$5. Pre-registration requests received after Jan. 4th, 1993, will be held at the door. Swap tables \$9 ea. for the first two tables. Commercial exhibitors welcome; write for details. Talk-in on 146.52 and 446.00 simplex. Contact **Northwest Missouri Winter Hamfest**, P.O. Box 182, Cameron MO 64429.

CHARLESTON, SC WCARS/VEC Exams will be held at Trident Technical College at 9 AM. Contact **Pat Foster** AC4IH, 117 Keenan Ave., Goose Creek SC 29445; Tel. (803) 553-3871. Alternate Contact: **Werner E. Dolder** AA4IX, 327 Heber Rd., Summerville SC 29483; Tel. (803) 873-9465. Walk-ins normally accepted.

HAMMOND, LA The Southeast Louisiana ARC will sponsor the 1993 Hammond Hamfest, to be held in the SLU University Center from 9 AM-4 PM. Free admission. VE Exams. ARRL and QCWA Meetings. Free Swap Tables (limited number). Commercial vendors may setup Fri. afternoon. Contact **Ernest Bush** N5NIB, 331 Rock Rd., Hammond LA 70403; Tel. (504) 567-1261 (days); (504) 542-0034 (eves.).

KNOXVILLE, TN VE Exams, for Upgrades only, will be held at Pellissippi State Technical Community College, Room B-129 (formerly STIK, Pellissippi Campus). Code tests at 10 AM, 10:20 AM and 10:40 AM. All written elements at 11 AM. Pre-registration requested. Send Form 610, copy of license and any CSCE, and a check for the exam fee (payable to WCARS/VEC) to be received by the day before the test. Registrations will be accepted in the exam room until 9:30 AM - none later. Contact **Ray Adams** N4BAQ, 4325 Felly Dr., Knoxville TN 37918; Tel. (615) 688-7771. Alternate Contact: **Rich Slover** ND4F, P.O. Box 30754, Knoxville TN 37930; Tel. (615) 539-4821. Novice testing on request from N4BAQ, ND4F, WA4GZE, N4IJL, W4MHA, WA4TKN and others.

LOUISVILLE, KY VE Exams will be held 10 AM-2 PM at the Government Center, Outer Loop 3 mi E I-65. Walk-ins only. Contact **Otis Herron** AA4HJ, 4810 Hood Rd., Louisville KY 40213; Tel. (502) 969-

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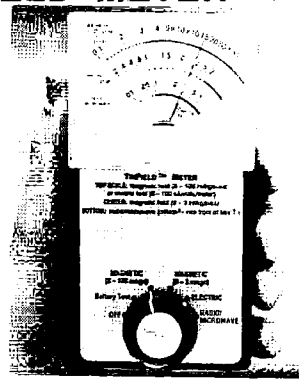
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7332. Alternate Contact: **Bob Happel** N4LXG, 2012 Ben Ali Rd., Louisville KY 40223; Tel. (502) 425-5260.

MONTEREY, CA The Naval Postgraduate School ARC will sponsor their 4th annual NPSARC Winterfest at Monterey Peninsula College Armory, from 8 AM-1 PM+, rain or shine. Free admission. Commercial vendors. Indoor Flea Market, \$10 per space. Demonstrations. Outdoor Tailgate Market, \$5 per space. Talk-in on 146.97. Contact **Doug KC3RL**, 9 Glenn Ave., Pinedale CA 93907; Tel. (408) 663-6117. Or call **Pat KA6IRS**, (408) 649-4444 ext. 20 (days only).

SPINDALE, NC WCARS/VEC Exams will be held at 10 AM at Isothermal College. Contact **A.B. Brackett K04BJ**, Rt. 2 Box 242, Bostic NC 28018; Tel. (704) 245-6334. Alternate Contact: **F. Bruce Tessinear KD4QJ**, P.O. Box 341, Henrietta NC 28076; Tel. (704) 657-5464.

JAN 17

SOUTHFIELD, MI The Southfield High School ARC will sponsor their 27th annual Hamfest/Electronics/Computer Swap & Shop at Southfield High School, 24675 Lahser. Doors open at 6 AM for exhibitors. Open to the public 8 AM-3 PM. Admission \$4, children 12 and under free. Tables reserved and paid for in advance @ \$15 for each 8' table (admission ticket required). For tickets and tables, send SASE with check (made payable to Southfield High School) to **Robert Younker, Southfield Senior High School, 24675 Lahser Rd., Southfield MI 48034**. For info, leave a message at (313) 746-8675. Long distance replies will be collected. Table reservations are on a first-come, first-serve basis. Indicate if you need electricity, and also, please indicate the kind of material you have for sale.

SUMTER, SC WCARS/VEC Exams will be held at 8:30 AM at Abundant Faith Church. Contact **Dan Mask WB5SGH**, 404 Sanders Dr., Sumter SC 29150; Tel. (803) 775-9106. Walk-ins normally accepted.

YONKERS, NY There will be a Giant Electronic Fleamarket at the Lincoln High School, Kneeland Ave., off Yonkers Ave., from 9 AM-3 PM, rain or shine. Free Parking. Admission \$4, kids under 12 free. Indoor Flea Market only. Set-up at 7 AM. No tailgating! VE Exams. Sellers: \$15 1st table, \$10 ea. add'l. table. All tables 30" x 5'; or bring your own table at \$1.80 per ft.—min. \$10. Full payment due with registration by Jan. 10th. No paid reservations for tables or space will be held past 9 AM. No refunds unless notification of cancellation has been received 72 hours in advance of the event. Tables are \$20 at the door, or \$2.50 per ft. For registration: **Otto Supliski WB2SLQ**, (914) 969-1053. Mail paid reservations to: **Metro 70 cm. Network, 53 Hayward St., Yonkers NY 10704**. Talk-in on 440.425 MHz PL 156.7, 223.760 MHz PL 67.0, 146.910 MHz, 443.350 MHz PL 156.7.

JAN 18

JAMESTOWN, TN WCARS/VEC Exams will be held at the First Baptist Church at 7 PM. Contact **Mike Ledbetter AB4BX**, Rt. 4 Box 759, Jamestown TN 38556; Tel. (615) 879-8626. Alternate Contact: **Fred Davis K8DOC**, 17 Sleepy Hollow, Jamestown TN 38556; Tel. (615) 879-9268. Walk-ins normally accepted.

JAN 22

ELIZABETHTON, TN WCARS/VEC Exams will be held at Moody Aviation - Carter County Airport at 7 PM. Applicants must be pre-registered the day before the test session. Contact **Joe Hopkins K4BKI**, 414

East H. St., Elizabethton TN 37643; Tel. (615) 543-4022. Alternate Contact: **Jon Christiansen AB4NN**, Echo Dr., Elizabethton TN 37643; Tel. (615) 543-7155.

JAN 23

ASHEVILLE, NC WCARS/VEC Exams will be held at 9 AM at the Health and Social Services Bldg. Contact **Norman G. Harrell N4NH**, 7 Skylyn Ct., Asheville NC 28806; Tel. (704) 253-1192. Walk-ins normally accepted.

CRYSTAL RIVER, FL The 13th Annual Citrus County Hamfest/Computer Show, sponsored by the Sky High ARC, will be held at the National Guard Armory located on Seven Rivers Dr., just south of the Crystal River Airport off route US19. Starts at 8:30 AM. All items to be 80% HAM related. Free Parking. Tailgating. Sell contained RV parking. Set-up from 3 PM-5 PM Fri., and 7 AM-8:30 AM Sat. 120V AC available at no charge (users must provide plugs, cords, and tape, where cords cross aisles). Admission \$4 until Jan. 9th, then \$5 thereafter. XYL's free with OM. All exhibitors and helpers must purchase admission tickets. Indoor tables \$15, chair provided. Outdoor spaces \$8 (does not include tables, chairs or power). All tables are 30' x 8'. Telephone reservations 10 AM-9 PM only. Payment must be received within 7 days or reservation will be cancelled. Confirmation mailed on receipt of payment and SASE. Talk-in on 146.355/955. Call **Billy WE4C**, (904) 726-2905, 10 AM-9 PM. Write: **SHARC Hamfest**, 8811 Maplewood, Iverness FL 34450.

GALLATIN, TN VE Exams will be held at 11 AM at the Red Cross Bldg., S. Water Ave. By Pre-registration only. Contact **Ronnie L. Gilley KA4LUG**, 512 Hillside Ln.,

Gallatin TN 37066; Tel. (615) 452-0883. Alternate Contact: **Jerry Goodchild K4DZR**, 233 Sterling Rd., Hendersonville TN 37075; Tel. (615) 824-7699.

GREENEVILLE, TN WCARS/VEC Exams will be held at Roby Adult Center, 203 N. College St. at 10 AM. Contact **Jack Creed K4EPC**, 826 Redbud Dr., Greeneville TN 37743; Tel. (615) 638-7056. Walk-ins normally accepted.

MEMPHIS, TN VE Exams will be held at 9 AM at Central Church, 6655 Winchester Rd. Contact **Win Guin W2GLJ**, 2138 Sonning Dr., Germantown TN 38138; Tel. (901) 754-4552. Alternate Contact: **Nita Wofford N4DON**, 2966 Cordell St., Memphis TN 38118; Tel. (901) 363-4971. Walk-ins normally accepted.

NEW BERN, NC VE Exams for Walk-ins only, will be held at 9 AM at New Bern High School. Contact **Andy Griffith W4ULD**, 203 Lord Granville Dr., Rt. 2, Morehead City NC 28557; Tel. (919) 726-5924. Sponsored by WCARS/VEC.

JAN 24-24

GALLATIN, TN The Tennessee Valley AR Network will hold its 3rd annual Middle Tennessee Hamfest/Packet Conference at the National Guard Armory on Hwy. 25 East. Set-up Fri. Noon to 6 PM; Sat. 5 AM-8 AM. Open Sat. 8 AM-4 PM, Sun. 8 AM-2 PM. Admission \$5 each day; XYLs and under 16 FREE. Tables \$10 for both days (includes 1 admission). VE Exams. Register Sat. 9 AM-11 AM. Pre-registration guarantees exam. Testing begins at 11 AM. Packet forums both days. Talk-in on 145.13-, 147.30+ and 442.600+, starting at 10 AM Fri, 5 AM Sat., 7 AM Sun. Contact **Bill Ferrell**, (615) 452-3962 after 5 PM M-F, anytime S-S; or write **TVARN**, 1120 Douglas Bd. Rd., Gallatin TN 37066.

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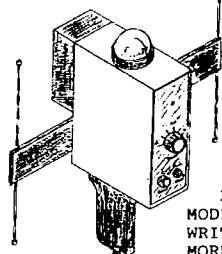
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JAN 31

DOVER, OH The TUSCO ARC Hamfest will be held at the Ohio National Guard Armory, 2800 N. Wooster Ave., starting at 8 AM. Set-up at 6 AM. Admission Free. Tables \$8 ea. Talk-in on 146.730 W8ZX rpt. Contact **Howard Blind KD8KF, 6288 Echo Lake Rd. N.E., New Philadelphia OH 44663; Tel. (216) 364-5258.**

WHEATON, IL Wheaton Community Radio Amateurs Mid-Winter Hamfest will be held at the Odeum Expo Center, Villa Park, IL, beginning at 8 AM. EZ access from major X-ways. NOW VEC Testing. Flea Market and Commercial tables available on reserved basis. Free and paid parking. Handicap access. Women's programs. Free shuttle bus. Seminars and more. Tickets \$5 in advance w/3 drawing stubs; \$6 at the door w/1 stub. Talk-in on 14.390. Contact **Wheaton Community Radio Amateurs, P.O. Box QSL, Wheaton IL 60189; Tel. (708) 629-8006 or (708) 629-8889.**

FEB 6

KNOXVILLE, TN The Shriners of the Kerkela ARS, Kerkela Shrine Temple, will sponsor KERBELA HAMFEST (was Sevierville) at the Kerkela Temple from 8 AM-4 PM. Admission \$2. Tailgating \$3 plus admission. Tables \$8. Set-up 4 PM-9 PM Fri., and 5 AM-8 AM Sat. No crafts allowed. Smoking in designated area only. Talk-in on 146.34/.94. For table info, contact **Paul Baird KY4A, 1500 Coulter Shoales Circle, Lenoir City TN 37771; Tel. (615) 986-9562.** FCC Exams by WCARS-VEC. Pre-registrations until 9:30. Code test begins at 10 AM. Written test follows at 11 AM. Mail completed Form 610 with check for \$5.40 (payable to WCARS/VEC) to **Ray Adams N4BAQ,**

5833 Clinton Hwy., Suite 203, Knoxville TN 37912-2545. Tel. (615) 688-7771.

LANCASTER, PA A Dutch Country Computer and Communications Show will be held at the Lancaster Host Golf Resort and Conference Center on US Route 30 east. Sponsored by the Columbia Area ARC, Inc. For info, contact **CAARC, P.O. Box 574, Columbia PA 17512; Tel. (717) 627-1597.** For Vendor info, Fax (717) 872-0857.

FEB 27

LaPORTE, IN The LaPorte ARC will host a Hamfest at the LaPorte Civic Auditorium, 1001 Ridge St., beginning at 8 AM. Set-up at 6 AM. Admission \$4 at the door (no advance). Tables, \$5 prepaid. Send payment, with SASE to **LPARC, P.O. Box 30, LaPorte IN 46350.** Talk-in on 146.610.

SPECIAL EVENT STATIONS

JAN 15-18

WASHINGTON, DC MADRAS, the Maryland Apple Dumping ARS, Inc., will operate W3UUS at the Russell Senate Office Bldg. on Capitol Hill, to commemorate the inauguration of the 42nd President of the United States, Bill Clinton and Vice President Albert Gore. Operation will take place from Fri. Jan. 15th, 2300Z-2300Z Mon. Jan. 18th. Frequencies: Phone—1.855, 3.905, 7.205, 14.270, 21.345, 28.490 MHz; CW—1.810, 3.640, 7.050, 14.050, 21.050, 28.050 MHz. Each evening the Station will operate CW in the bottom of the Novice bands; 80m 7PM-8 PM, 40m 10 PM-11PM E.S.T. The operator will adjust his code speed to that of the calling station. For certificate, send 9 x 12 SASE to **MADRAS, Box 2468, Wheaton MD 20902, U.S.A.** Visitors to

the Virginia, DC and Maryland area needing help or info, contact **MADRAS 145.45, 444.1 or 146.505 simplex.**

JAN 23

AUBURN, NY The Auburn ARA will operate KC2VB from 1500Z-2100Z to celebrate the bicentennial of the founding of Auburn and Winterfest. Operation will be in the lower 25 MHz of the General 40, 20, 15, and 10m bands, and the corresponding Novice bands. For a certificate, send a 9 x 12 SASE to **Stan Gutelius KC2VB, 4 Elizabeth St., Auburn NY 13021.**

JAN 23-24

EVANSTON, WY The Uinta County ARC will operate NW7H 1500Z-2400Z, to celebrate the Chinese New Year, in the only city in the Rocky Mountains observing this holiday. Phone 10X on 28.395, 24.945, 21.325, 18.140, 14.245, or CW on 7.122. For a certificate, send your QSL with 9 x 12 inch SASE to **Vranish, P.O. Box 2048, Evanston WY 82931-2048.**

JAN 28

SAN DIEGO, CA The Challenger Junior High School ARC will operate K16YG from 1500Z-2400Z, to commemorate the Challenger Space Shuttle tragedy that occurred on this date seven years ago. Frequencies: 14.270, 21.270, and 28.270. For a special QSL card, please send your QSL and SASE to **Frank Forrester K16YG, Challenger JHS ARC, 10810 Parkdale Ave., San Diego CA 92126.**

FEB 5-6

VERMONT The Central Vermont ARC (W1BD), and The Burlington ARC

(W1KOO), will be multipliers for The 30th Annual Vermont QSO Party. 24 hours only! 7 PM Fri.-7 PM Sat. EST. All licensed amateur radio operators are invited to participate. Frequencies: Phone—160-10m. First 25 kHz up from the beginning of General phone band privileges, and Novice phone 10m privileges. CW—40 kHz up from the bottom edge of the bands and 20 kHz up from the bottom of Novice portions. VHF—50.200, 144.200, and 146.49 MHz. Other modes in the customary section of the respective band. Repeater contacts not allowed. Exchange: VT stations send RS(T) and County. CW two-letter designator as follows: AD, BN, CL, CH, ES, FR, GI, LM, OG, OL, RT, WA, WM, WR. Other stations send RS(T), state, province, or DX-CC country. Scoring: VT stations count 1 point per phone contact, 2 points for CW, digital, ATV etc. Multiply by number of VT counties, states/provinces/countries, W1BD and/or W1KOO QSOs. Other stations count 1 point per VT phone contact; 2 points per VT CW, digital or ATV contact. Multiply by number of Vermont counties and W1BD and/or W1KOO QSOs. A station may be worked twice per band: one phone contact and one other type mode per band. Awards: VT stations submitting a log will receive a Special Certificate. Plaques will be awarded to the 3 highest scoring VT stations. Other stations receive Special Certificate for highest scoring station in each state/province/country. The WVT Award is given to stations working 13 of Vermont's 14 counties. Send logs/facsimiles, name, address, call, whether single or multioperator, postmarked no later than March 1, 1993 to: **Bob DeForge K1HKI, RR1 Box 271, Brookfield VT 05036.** Please send SASE for results.

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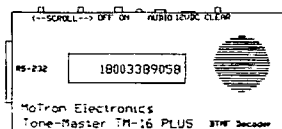
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Continued from page 67

the body is in danger. This response works on a very fundamental level, operating through what we consider as instincts. Though we quickly become aware of pain on a conscious level, we realize that by that time we've already reacted to it subconsciously. If we had to wait for the pain message to reach the conscious mind and tell us to take our hand off the stove, we'd do a lot of damage. No, the hand jerks off way before we know what hit us.

We learn from this. The next time we see a stove we're suddenly careful and tend not to touch it. This isn't entirely a conscious matter, it's a built-in reaction. Pain equals the vision of the stove on a subconscious level. Well, this is often a very valuable survival system. But like any system that works automatically, it's often going to be wrong and send false alarms.

On a completely subconscious level the mind equates pain with all perceptions being received at the same time . . . visual, sonic, and so on. By the time we have thousands of pain incidents the brain is fairly well tied up with neurons dedicated to these pain avoidance equations. I found this out personally when I worked with people under hypnosis removing these pain equations and discovered that their IQs were measurably zooming upwards and their

mental awareness was going higher and higher.

So what's all this got to do with the prenatal period? Well, the avoidance of pain system seems to be so fundamental that it's in operation right from the beginning. So what pain does a fetus experience? The baby gets all its food directly from the mother through the umbilical cord, right? This means the baby is in tune with the mother. When the mother is in fear her system shoots adrenaline into her blood to help her fight or flee. I hope you won't think it surprising that this chemical attack also shocks the baby. The baby records the sounds being heard and equates them to the adrenaline shock. The sounds are recorded, just as they would be on a tape recorder. The baby doesn't understand what words mean, but in later life that word pattern is going to be equated with a shock to the system and the baby is going to subconsciously react negatively.

Now, the next step in this process. If you think of the baby's mind as acting a good deal like a computer you won't be far off. It's a computer far beyond anything we can even hope to build yet, but it does act like a computer in many ways. The baby gradually learns to deal with its environment. It's very comfortable most of the time during the prenatal period. The temperature is perfect. The food is great. And there's the comfort of a sort of spiritual communi-

cation with the mother.

Babies are programmed very much like computers in that the early instructions are the foundation upon which later instructions are built. If you start with a weak or faulty foundation, no amount of later patches are going to give you the perfection you'd have had without the bad foundation. Make sense? Now do you see why I attach so much importance to what happens during pregnancy?

When mothers don't eat right this permanently affects the child. No amount of good food later on will ever make up for it. When the mother drinks alcohol this zaps right down to the baby. This is traumatic. This is pain! Is it any wonder that the children of mothers who drink during pregnancy have so many problems later on? And the fact is that we're just beginning to find out how many problems this can generate. We know it affects intelligence and health. Well, the same goes for nicotine. When the mother smokes, the nicotine hits the baby like a sledge. Wham! Other stimulants such as caffeine also register as shocks to the fetus. And I don't have to explain how drugs can not just screw up the genetic development of the baby, but set up all sorts of bum basic programming.

There are other shocks which register with the baby such as when the mother falls down or is hit in the stomach. All of these shocks are duly

recorded, right along with the sound patterns for later avoidance.

The birth process is enormously traumatic. Families who are aware of the importance of keeping these pain avoidance equations to a minimum insist on the birth being kept as quiet as possible. No talking. No unnecessary sounds. For years doctors scoffed at this silly notion, but recent research has proven how important a quiet birth can be, so we have fewer skeptics now.

The more we can help women understand the importance to their child of their health, the food they eat, the need to avoid chemical attacks on the baby, and the need for silence when there's a chance the baby might be feeling pain, the better will be the most basic programming of the child.

So how about sex during pregnancy? The baby is going to enjoy this right along with the mother as the pleasure chemicals reach it and the feeling of happiness is shared.

A few people are working on ways of going back under hypnosis and erasing these early pain memories. You can read more about this in *The Holotropic Mind* by Grof (1990—\$20), if you're interested. The first work in this area was described by Alfred Korzibski in his *Science and Sanity* (1935). I plan to write on the nuts and bolts of how to do the repair job when I have the time. But it's a lot easier and cheaper to be careful and not mess up a child's development

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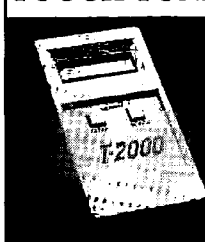
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during the first nine months, the most basic of all learning periods. I hope this makes sense to you.

Age #2

The second most important educational period is from birth through to about the first birthday. And if you think we're screwing up our children during pregnancy, wait! I'll explain what we've been doing to the little darlings after they're born. You're not going to like this.

Let me ask a very basic question. How important is your child to you? How important is it that your child be given every opportunity to grow up to be the best kind of person you can manage? Would you do anything knowingly that would permanently cripple your child? Would you do anything knowingly which would result in your child having a low IQ? Would you do anything that would tend to have your child become a drug addict? To be an alcoholic? To be a misfit in society? To become a criminal?

What's it worth to you to be fairly sure that your child will grow up to be healthy, intelligent, happy, have a good marriage, and be successful in life? No psychoses? No allergies? If you handle your child's education on every level according to what we know now about how children develop, you'll have a good chance at producing a terrific winner.

Which brings me back to birth, a process which we've managed to louse up almost beyond recognition. So what happens to the kid when you shoot the mother full of drugs so she won't have to feel the pain? Babies need all of the strength they can muster to cope with the birth process. The last thing they need is to be drugged.

Now let's tackle the biggest problem we have with birth, which is what happens immediately after. Think about this for a moment. For thousands of generations children were born and immediately put with their mothers. The child has just spent a few months being fairly close to its mother. It's bad enough to have to get the lungs going and shift to air and breast food, but then to go against a basic instinct by taking the baby away from the mother, it's no wonder babies cry and are traumatized.

We recognize the power of instinct in birds, animals, insects, reptiles and so on. So why are we so blind to human instincts? Do we even for a moment deny they exist? When we look at primitive tribes we find that children are put with their mothers immediately after their birth. Further, they stay with their mothers night and day until they learn to crawl.

The hospital nursery is a cruel, painful time for babies. It goes against hundreds of thousands of years of instinct. When babies are put with their

mothers they don't cry. When they are allowed to stay with their mothers they don't cry.

Allowing babies to stay with their mothers day and night for the first year is going to be even more difficult a change. Our society isn't geared for this. Oh, we're beginning to recognize that mothers should have a few weeks with their babies. We're seeing moves towards maternal leaves from work. We've got to do more than that.

Just the other day I was watching a PBS program showing how young children are treated in various countries. One of the groups visited was a primitive tribe. Here the babies were kept with the mothers. Mothers carried their babies around with them everywhere. The interesting part was that in this situation none of the babies cried. And as they grew up they didn't fight with other children. The kids all happily lent a hand with their younger siblings when needed.

If the whole concept is interesting you'll enjoy reading *The Continuum Concept* by Jean Liedloff (1991—\$9). The subtitle is, "Allowing human nature to work successfully." You'll see why I recommend that businesses encourage mothers to bring their babies with them to work. It'll make happier mothers and babies.

When we separate babies from their mothers we're going against eons of

instinctive behavior. What a great introduction to the outside world! The baby doesn't think, it reacts. It knows something is terribly wrong so it cries. After nine months of being warm and protected by the mother babies need to feel her next to them. They need to feel her warmth, her voice, her touch. They need to feed when they feel hungry.

Perhaps you've noticed that your body tells you in no uncertain terms when it needs food. If you delay the message gets more painful. This is self-preservation at work. Babies feel the same thing, only it's a much more powerful urge for them and traumatic when not fulfilled immediately. Pain! And that means more negative programming of this new computer system. Is it any wonder we're such psychological messes a few years later? Is it any wonder we're all having to diet . . . or at least should?

It's going to take some re-education to change our society so it gives babies the best educational start we can. This means understanding how what we do affects babies during pregnancy. And it means changing things so mothers can keep their children with them for the first few months . . . until they are ready to separate on their own . . . instinctively. Once they're ready they'll start crawling and exploring. Then they'll gradually adjust to being separated from mother and we'll get into Age #3, that time from around the first birthday

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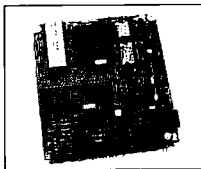
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until their formal education starts in school.

This approach should make sense and appeal to most people, despite the need for changes in our society. It fits in with what we know. And if we can bring it off we're going to have far happier, intelligent and better motivated kids.

There are some less obvious influences on babies that we'll eventually have to deal with. We can see some of these at work with other animals. You've seen the way schools of fish can change direction instantly. We've seen how people can change when they are in a group. We need to understand more about how mob psychology works. What turns individuals into a lynch mob? Into a cheering political group? Into mass-hypnotized rock 'n' roll groups? Into feeling a group religious experience?

And how do we deal with mental communications which occur on a subconscious level and are thus extremely elusive to study? If I'm encouraged to explain how to repair the mind . . . how to find these pain avoidance memories and erase them . . . then we're going to get deeper into the metaphysical. Then we're going to start dealing with life, death, past lives, reincarnation, and other things that are outside our normal Newtonian, Aristotelian everyday world.

It's a lot simpler to accept the obvi-

ous. The sun comes up every day, so obviously the sun is rotating around the earth. Do you know that there is a fair percentage of Americans who don't understand that the earth circles the sun? When we look at matter we know it's there. We can see it and feel it. Then we go to school and find out that matter is made up of molecules. Molecules are made up of atoms. And atoms are made up of electrical charges all held in place by forces which we don't see, feel or experience in everyday life. Newtonian physics doesn't hold when you get outside of our normal frame of reference. Nor does Aristotelian logic.

Quantum mechanics doesn't make any Newtonian sense at all. We're changing electrons into photons and back. We're splitting photons and suddenly we're defying time. Well, this is where we're getting in our understanding of how the brain-mind-spirit-body work. A book you'll find absolutely fascinating is *The Holographic Universe* by Michael Talbot (1991—\$10). But get a good grip on yourself because you're in for a wild ride . . . and you'll never be the same again.

As you begin to understand how the mind and body are integrated you'll see where I'm headed when I suggest we investigate how the mind works as a better approach to health care than just treating germs, viruses, and other symptoms. I suspect that for about the same investment it takes to bring one

new drug to the market we could prevent around 90% of sickness via tackling the psychological components which have triggered the problems.

When I get some time I'll continue on with my recommendations on Age #3, which will include the day-care and pre-school years. It's during this critical period that around 80-90% of our life patterns and habits are established. It's a lot easier to teach good survival patterns during this period if we start with a solid foundation of learning from conception on through the break with mother . . . into when we can use language for communication.

Babies and Hamming

What has all this got to do with amateur radio? Why should you care one zot about how babies are brought up? Well, I'm trying to solve a problem and, as in most solutions to problems, it's necessary to go back to some basic roots. My aim is to help improve our American quality of life. That's my most basic goal. It's obvious to me that the more skilled our work force in the next century, the better off we'll be. We see low-skilled jobs being moved to lower wage countries and we know that this is a process that can't be stopped. We can fight it with rhetoric and tariffs, but marketplace competition will eventually win out. You can't keep imports out with tariffs. Look at the hundreds of billions we're spending trying to keep out drugs. And look at

the total failure we've had with this approach.

Okay, we need higher skilled workers. This means skills in high-tech businesses and manufacturing. And this means better education and motivation. So I envision our having millions of kids interested in amateur radio as a way to be motivated to learn. We know from our history that if we get kids interested in hamming early on they almost invariably continue on to be technicians, engineers and scientists. In the '50s an ARRL study showed that 80% of all hams who started in their teens went on to high-tech careers.

So my approach is to provide the educational system which will attract youngsters to high-tech hobbies such as amateur radio, computers, electronic experimenting, and so on. And, the more I looked into the educational system, the more I understood how it starts out at conception, not when kids first enter school. So there you are.

We need to make major changes in our Age #3 educational approach. And we also need to make even greater changes in our Age #4 system, which takes us into adolescence. Hey, we'll get all this into shape eventually . . . and when we do, we'll not only be a model for the whole world (again), we'll be the leaders in an incredible world market for our educational products. And that's going to be a trillion-dollar market.

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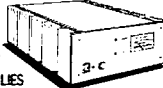
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Techno Whizzy, Part II

Continued from page 14

OK, but more than 0.3 volts means something is wrong. Check the biasing resistors—and is the transistor in backwards? (Mine was.)

Hook the RG174 cable from RF out on the DDS VFO board to the input (J3). Plug a scope into the "hot" end of R5 and apply power to the TW-1 via the J2 on the power supply board. If you're still set to 7040 kHz and channel 12, you should see a nice sine wave at about 0.7 volts peak-to-peak. Hook the scope up to the output at C3 (you should see very little), then key the unit and you should see 4 volts p-p. That's 40 milliwatts, enough power to make a contact by itself. However, we can run a little more than that, so let's do the final amp.

Hook the scope up to the center conductor of the antenna jack and key the unit. You should see a nice sine wave at over 15 volts p-p. Turn switch SW1 off and it will go away. If you don't see this, check the usual suspects—resistors of the wrong value, transistor dead or in backwards, mis-attached transformers, etc.

This amplifier is linear down to about 11 volts, but below that it has a small amount of distortion. To remove this distortion will require a filter between the amp and the antenna. I've included a schematic for a five-pole

filter that'll keep your TW-1 FCC legal if you run with a low battery, and a parts list indicating what values of caps and inductors to use. Boards for this are available from FAR Circuits (18N640 Field Court, Dundee IL 60118), and a chart of what components to use for different bands is listed in the sidebar.

If you want to run the TW-1 on all bands with a dying battery, you'll need to switch in different filters. Use a two-pole six-throw switch (available from Radio Shack) to switch different filters in and out.

You're done with the "radio" part now, so let's do the case. Pick a nice case—you'll want to show this off at the club. Make sure there's some extra room inside for a few more boards (for the digital front-panel and receiver boards, at least).

The back of the TW-1 needs a power jack, a fuse, an antenna jack and a reset switch. I usually use an SO-239 or RCA phono jack for the antenna connector, and a panel-mounted fuse holder (so I can change the fuse without dismantling the radio). The power connector needs to handle about 1.5 amps. The reset switch is an SPST NO momentary push-button switch—you'll probably never need it but it's there just in case.

On the front you'll need room for a 12-position rotary switch, the T/R switch, the key jack and perhaps a light to remind you the TW-1 is turned on. Label each position

of the switch for which frequency you're using. The key jack can be a 1/4" headphone jack—run your TW-1 from a straight key or a keyer.

Congratulations, you've just done the impossible—built your own home-brewed digital radio! Prepare to have fun with your new Direct Digital Synthesized Techno Whizzy model 1 transmitter. Maybe you'll be the first DXCC with QRP DDS!?

So, what's the next step? How about a digital front-panel with LEDs and a keypad for frequency input to replace the diode array? Or a receiver board to turn the TW-1 into a full transceiver? Or a mod to use the TW-1 as a signal generator with tracking, to turn your oscilloscope into a filter sweeper? Or a mixer to run the TW-1 at 6 meters? How about adding 8K worth of battery-backed-up memories and a CAT (computer assisted transceiver) interface? SSB, anybody? Maybe a 5-watt amplifier stage?

All of these are planned, and the first two are being prototyped already. Watch for them in the next few months. If you have an idea you'd like to add, drop me a line. I can explain what's planned for the 50-pin headers so your device won't interfere with the other boards.

You can write to me at 1307 N. Richmond Rd, Apt H, McHenry IL 60050, or contact me on Usenet at jjw@precipice.chi.il.us or on CompuServe at 70410,1642.

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Notes from FN42

It is now the beginning of a new year. What lies before us? Might it be world peace? It is encouraging to hear that some countries that have been having civil wars are now pursuing peaceful means of settling their differences, as in Mozambique as reported by Phil Gray KA7TWC/C9RPG.

We as hams have a chance to exercise our rights to help each other and to help new hams get started in our wonderful hobby. Last year I mentioned that a group of hams in the Keene, New Hampshire, area had provided evening classes for the Novice/Tech licenses. I just finished talking to several of those who participated in the teaching of the classes and they have all enthusiastically volunteered again, even the one who spent many hours coordinating the effort. All we need to do now is set the place and the dates and let the word be known to the local media, packet, local nets, etc.

If you feel that you can't do this, or that you will let someone else do it: Before you make that final decision, please read the parable in the news from Australia. Then, think about how it relates to amateur radio and you.

GET INVOLVED! 73, Amie N1BAC.

Roundup

China China Ham News, Issue No. 1 from the Tsinghua University Amateur Radio Club, edited by Rick Hunter, Public Relations Manager: Hello from Beijing! BY1QH is the radio shack located on the 4th floor of a dorm on the campus of Tsinghua University. The campus is located in the northwestern part of Beijing, roughly 10 km from the city center, Tiananmen Square.

The equipment in the shack consists of an ICOM IC-750A, an AEA PK-232 TNC, an IBM 286 computer with a 20 meg. hard drive and monochrome monitor, and a four-element 14 MHz yagi, a three-element 21 MHz yagi, and a vertical. We have an ICOM amplifier that is inoperable at the present due to a bad 2SC2652 (we think). That sort of part is very difficult to locate here so if anyone might have one laying around and would send it to us, we would be extremely grateful.

We were honored to have Mr. William Santelmann N1AU from Massachusetts pay a visit, along with his friend Carl Lehr, on April 10, 1992. Besides having a look around the radio shack, Bill gave a terrific lecture on "The Incredible Ham Radio" to as many as 200 Tsinghua University students. His talk was very warmly wel-

comed. Bill also kindly presented us with the 1992 ARRL Radio Amateur Handbook and a copy of "CT," well-known computer software for contesting logging developed by K1EA.

Mr. Bob Boyd W1VXV from Maine, together with his XYL Carol, had an eyeball QSO with us on September 2, 1992. Unfortunately, we had some problems with our rigs at that time so he couldn't operate, but they had a good time talking with the students on campus. The Boyds previously visited BY1BJ and BY1PK.

BV3AC of Tsinghua University in Taiwan, and BY1QH of Tsinghua University in Beijing took part in the Jamboree-On-The-Air (JOTA) activity in October on 15 and 20 meters. JOTA is an annual event sponsored by the World Scouts Bureau in Geneva. Our special gratitude to Mr. Wang Wenlong BV3AC for his wonderful ideas and information.

BY1QH has just registered at the JASTX AMTOR/PACTOR mailbox. Because of our limited output power and the recent poor propagation, this might be the only mailbox that is available to us. Feel free to pass messages to us at JASTX.JPN.AS. [The path works because I have already passed a message and received a reply passed back by VE7CIZ—Amie]

We are quite new to packet radio, although the interface we are using may enable us to show up in the BBS mode. We badly need to know how to get into a BBS and any information will be appreciated. Is e-Mail available from a BBS?

Our present QSL information listed in the callbook is PO Box 2654, Beijing, People's Republic of China. If you have sent a QSL before but have yet to receive one in return, we would like to mail another, provided you request again. A BT80TUA Special Event QSL (voided) will be sent simultaneously as a gift. For faster reply use the address at the end of this file.

The latest figures show that there are 77 amateur radio stations all throughout China at present. BY1QH has the QSL Info on 76 of them, which might be of help to you. Don't hesitate to ask if you have no idea where to send the card. An SASE is of course nice to have.

Our thanks go to Bill N1AU, Bob W1VXV, Wang BV3AV, Ted W2FG, Ray NV2A, Don W8OJQ, Jim N2HOS, Joe N4QQ, Wang BY1BJ, and Tong BY1PK for their support and help. In addition, special thanks to JA1AN for sending us JARL News magazine, and to our Taiwanese friends who have mailed us their CO Amateur Radio magazine. In particular, thanks to JASTX for making all this news file possibly known to others.

For further information, or any help that is available, please send messages to me at JASTX.JPN.AS, or at this address: Rick Hunter, Room 316, Building No. 25, Tsinghua University, Beijing 100084, People's Republic of China.

The BY1QH news may be sent by any means to anyone or any institution without asking for permission. Our sincere appreciation to you for letting others catch up on our news.

[This information was downloaded from packet. It was downloaded from JASTX at VE7KIT on PACTOR, then distributed by VE7CIZ, George. VE7KIT is in contact with JASTX (Mitsou's PACTOR/AMTOR BBS in Kochi) two or three times a day. If you have messages that you would like to send to BY1QH, you can send them to VE7CIZ @ VE7KIT. #VANC.BC.CAN.NA, and he will be glad to pass them on via JASTX.—Amie]

Philippines Sent by Rainier R. Baulista DY9CKQ CQ, CQ, CQ . . . OUR RADIO CLUB IS DYING! The world of amateur radio is expanding in some parts of this planet Earth. Every second, the airwaves are so crowded with so many languages, sharing ideas, jokes, hobbies, experiences and so many other things a human being would like to express. Somewhere, there are hams going on DXpeditions while others are hunting for more and more fellow hams in the air for their DX awards. Others are learning the Morse code and reviewing their theory of simple electronics and radio laws while others are assembling and testing their home-brew radios or perhaps constructing their magnificent and gigantic steel towers decorated with different kinds of antennas . . . yet somewhere in this world, an amateur radio club is dying.

It was 1985 when the Organization of South Cotabato Amateur Radio (OSCAR) was organized in the southernmost part of DU-land, the Philippines. It actually started here in our town, Koronadal or Marbel, but the members were outnumbered by their invited interested parties from Gen. Santos City, which is 57 kilometers away. When the association was registered with the Securities and Exchange Commission, it was addressed to them and they got most of the credit from the Philippine Amateur Radio Association (PARA) and from everywhere else in the world as DX9-OSCAR. During those times, the group constructed a repeater station at the foot of Mt. Matutum, but it was not strong enough for a hand-held transceiver to trigger. For more than a year now the repeater station has not functioned due to some technical problems.

There is one president of our club, while there are two people for the rest of the positions, i.e., two vice-presidents, one for the city and one in South Cotabato; likewise for the secretary, treasurer, auditor, and press relations officer. The group has one

organizational chart, but on functional aspects it is separated. Here in Koronadal, the station is called OSCAR-MARBEL.

In 1990 I began to have an interest in this hobby so I joined OSCAR-MARBEL because one of the organizers was my father and he had suggested the name of the group. He was not able to continue this expensive hobby because of the examinations. I was an associate member, being the second operator of Dr. Gerte Pingoy DU9EP. Now I have my own callsign, DY9CKQ, as a Class "D." I have just passed the 5 wpm CW and I will be upgraded to DU9CKQ as Class "C" in December. This means I could already operate on HF and my dream of DXing will be realized somewhere in the future.

At my age (21 years old, second youngest member of the group) and as a graduating student in a Norte Dame school, I was nominated and elected this month as 1993's vice president of OSCAR-MARBEL. I "won" because I was the only nominee. Nobody else would dare to handle the responsibility of leading a dying organization. That is why I had to take the role because I saw and felt the importance of amateur radio in our community.

During the first four years of OSCAR-MARBEL's existence the group was very active when it came to communication, fellowship and sportfest, community service (monitoring the peace and order of the town for 24 hours), and they could even garner 40 to 60 stations to check in during the net. In the fifth year, the achievement of the club started to deteriorate and it even ceased its operation twice, for almost eight months between 1989-1990, and for three months in early 1992. Today we can have five to 15 stations join our net even though there are 50-75 hams within the town, not to mention associate members.

Perhaps leading the club at this age is somewhat difficult, but I think it is a good experience and opportunity for me to undertake. Yes, of course, I have my own dream—a dream of having a conversation with a lot of people out there—a dream of having certificates and plaques displayed on the bamboo walls of my small room—a dream of becoming a hamwriter, sharing my experiences and ideas that could contribute to the development and progress of radio amateurism and that could inspire newcomers—a dream which made me move forward and have a deeper interest in this hobby. Yes, I know that it will be a long, long way to go, and I believe that along the way, helping to reactivate my club, my dreams will be achieved.

And the question goes again . . . is our radio club dying? If I have to base my answer on the present situation, "No, it is not. It's just being paralyzed!" But if I have to compare it to the past activity of the club and to the

status of other amateur radio organizations, "YES, OUR RADIO CLUB IS DYING!"

For all of these, I am just wondering if there is anybody out there who could extend their help to the development of our amateur radio club here in the southernmost part of the Philippines? If so, please write to me at the following address: Rainier R. Bautista DY9CKQ, OSCAR-MARBEL, c/o Marbel Peterpan, Koronadal, 9506 South Cotabato, Philippines. [Does this sound like your club or a club you know? If you can help, do so. It means so much for so many people, especially Rainier.—Amie]

Republic of Slovenia Letter from Joseph Zelte W8FAZ. Source: Slovenec, October 22, 1992: Anton Stipanich, President of the Association of Radio Amateurs of the newly formed Republic of Slovenia called a press conference on October 21. The occasion was the coming worldwide competitions involving some 3.5 million amateurs in 300 countries.

"With the attainment of self-government and independence of the Republic of Slovenia, the Association of Radio Amateurs of Slovenia has likewise arrived where its members will be able to take an active part on the world scene. For on October 24 they will get the new call signs whose first part, S5, indicates the Republic of Slovenia." [The information received and published last month was incorrect; 4N3 may be for Croatia.—Amie]

It was the Slovenian amateurs who first let the world know what was going on during the brief failed June war last year. In the Bosnia war, Slovenian amateurs have been contacting fellow hams there and getting all kinds of information. Thus the thousands of war refugees in Slovenia are learning about the true situation regarding their relatives back home.

The association is comprised of 89 clubs, including over 300 active members. In the tradition of amateur radio, President Stipanich further pointed out that Slovenian amateurs especially stand out during natural catastrophes and disasters. For example, during the heavy floods last spring hams provided many reports. Beside their contribution in the Slovenian war effort, they also aided the victims of earthquakes in the areas near Slovenia.

Stipanich also saw the worldwide competitions scheduled for October 24 as an excellent opportunity to promote Slovenia throughout the world.

Frank Mocnik KP4AOD of Orlando, Florida, reports that S5 would signify Slovenia. A second numeral would indicate the district. Thus S51, S52, S53, etc. will probably be the new international prefixes replacing the old defunct Yugoslav YU3 call sign.

Switzerland From the International Telecommunication Union Press: The Asia Telecom 93 Exhibition and Forum will be held in Singapore from 17 to 22 May 1993 under the theme "Telecommunity; The Next Era Of

Growth." Hosted by Singapore Telecom and the Telecommunication Authority of Singapore, Asia Telecom '93 is organized by the International Telecommunication Union (ITU) and will take place in Singapore's World Trade Centre, ideally located and offering advanced exhibition and forum facilities.

For additional information, please contact: Ms. Suzan Hee-Sook Lee, Project Manager, Asia Telecom 93, International Telecommunication Union, Place des Nations, CH-1211 Geneva 20, Switzerland. Tel: +41 22 730 5811; Fax: +41 22 740 1013.

USA Note from Stu Stephens K8SJ: "I will be active as VP2MK8SJ, Montserrat, British West Indies, February 5-17, 1993: all bands, mostly CW, 20-30 kHz up from the low-band edges. QSL via the 1992-93 Callbook address: Stu Stephens K8SJ, PO Box 266, Girard OH 44420. Non-SASE QSLs will be routed through the Bureau. All QSOs will receive a QSL!"

AUSTRALIA

David Horsfall VK2KFU
PO Box 257
Wahroonga NSW 2076
Australia

I have been waiting for further details of the new licence structure in Australia, and by the time you read this, they will have announced it at the SEANET '92 Convention in Darwin, Australia. The announcement itself would have been relayed on the various WIA broadcasts. Apart from the general deregulation of conditions (especially packet radio), Novices are expected to be the main beneficiaries. My next "73 International" column will carry full details.

The VK4 (Queensland) Division of the WIA and the Queensland Department of Education have submitted a joint proposal to the DoTc on using ATV to link classrooms during school hours, when most amateurs are at their jobs. Comments from amateurs were solicited, and this has already upset a few people, who appear to be concerned about the "commercial use of amateur bands." This is an ideal opportunity to expose school children to amateur radio, but naturally it will need to be carefully controlled to ensure that amateur frequencies remain in amateur hands.

A recent High Court decision has upheld the right to "political" free speech, to counter a proposed ban on political advertising. It is worth noting that Australia has no right of "free speech" as such. The relevance to amateur radio is its possible impact on the packet radio network, since sysops (system operators) were free to delete what they thought were obnoxious or illegal bulletins; this is now thought to be in doubt by some.

Finally, it appears to be fashionable amongst the uninformed to "bag" the WIA (Wireless Institute of Australia) for various perceived shortcomings,

and I gather Australia is not alone in this respect. Whilst no organization can be 100% perfect, amateurs' interests would be better served by offering constructive criticism and volunteering to help wherever necessary. I leave you with this parable, relayed to me by Richard Murnane VK2SKY, although it may not be original: A man was wandering alone in the mountains, in the middle of winter, and in great danger of freezing to death. Just as darkness was falling he came across the smoldering remains of a tree that had been hit by lightning. He said to the remains of the fire, "I will get you some wood and build you up into a fire, but only if you warm me up first," and lay down next to it. The next morning, the fire was dead. By some odd coincidence, so was the man...

Cheers for now. Those with access to Internet or packet can contact me as "dave@esi.COM.AU" (note the new address) and "VK2KFU @ VK2RWI.NSW.AUS.OC" respectively.

MOZAMBIQUE

Phil Gray KA7TWQ/C9RPG
c/o CARE, C.P. 4657
Maputo
Mozambique

Peace at last! Or at least there's a good start. Through the efforts of several western and southern African nations, Mozambican peace talks began in Rome last year. The peace initiative in Angola was also helpful in getting the discussions started. After several months of false starts and more months of various derailments or disappointments, peace was finally signed 3 October 1992. This was good news and a very important first step, but there was no dancing in the streets. The ordinary Mozambican has had so many promises broken and hopes dashed in the past 15 years that he has become a very wary, if not cynical, person. When I arrived here in January 1987, the country was Marxist, destitute, and in the middle of a civil war in its 12th year. But worse, amateur broadcasting was prohibited!! Even so, four

hams have been granted limited broadcast permits over the years: an employee of the Swedish Embassy, a German tourist, and the traveling Colvins. But the efforts of the rest of us finally paid off last year when the government legalized amateur radio and opened an official radio club in May 1991. Since then we have been on the air in fits and starts with an American, Steve Marshall C9RSM, the most frequent user. There may be a total of seven of us, two of whom have stations at home. After I installed the SatellLife ground station at the university medical school in December 1991, I was on OSCAR 14 until February when amateurs were moved to OSCAR 22.

The urban economic situation began to improve as Russia underwent its changes three years ago, but conditions in the rural regions remained the same—or worsened—as the war continued.

So what now? Elections are to be held within 12 months and I have seen campaign posters up already—a positive sign. The countryside needs to be rid of marauders, thugs, and gangs that prey on villagers and farmers. This will take perhaps five years alone, maybe 10. The roads and railways need to be rehabilitated so goods and people can move within the country and exports/imports can cross its borders. South Africa and Swaziland are 50 miles away from the capital, Maputo, but we cannot go due to bandit or rebel attacks. We look forward to a safe drive before I leave in June—just to say we've done it.

With a coastline the length of California's, there also is (and was) tourism capability. That, too, needs to be rebuilt and staff trained. And speaking of training, most of the schools in the country have been severely damaged and books lost, stolen, or destroyed. Same or worse for the hospitals.

So we're at a critical point in the nation's history and development, but at least and at last amateur radio is back on the air. Listen for us on the weekends.

73

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MMIC Amplifiers

This month I will cover MMIC amplifiers. A few questions have popped up from our readers covering surplus MMICs and how to identify them. I will focus on surplus MMICs that I have obtained, describing how to identify them. There is no problem in component identification for those who purchase exactly what they desire, but what about those of us who scrounge components and MMICs from surplus PC boards? How do you recognize and identify them?

I will also cover the pinout information for the most popular MMIC amplifiers. This can be confusing—in my own scrounging I recognized that a different series of markings was used to identify each component but I didn't realize just how far this marking scheme went. Identification of devices from several manufacturers or even between devices from the same manufacturer on surplus PC boards was, at the beginning, not easy. The further I explored this the easier it became, and I am sure it will be easy for you as well.

What I got into in my trip through the junkyard surplus dealers were component parts labeled A-06, A-01 (letter-number), and 414 (totally numerical). Other devices had dots of various colors on top of the plastic case of what I believed to be MMICs. These were the devices that partially populated the surplus PC boards of interest to me. The problem with these miniature components and corresponding miniature part numbers is one of identification. You must realize that this numbering scheme is not limited to just MMIC amplifiers but can cover transistors, GaAsFETs and other devices. Some of these packages can have very small case dimensions with correspondingly small identification markings because there's not much room for large part numbers.

For instance, GaAsFETs seem to be identified with a two-letter code like Af, Be, Hj, etc. I have not yet broken this code for the GaAsFETs, but I believe these devices are manufactured by Fujitsu. Better luck prevailed with the MMIC amplifiers—I was able to decode their part numbers.

The MMIC amplifiers that I obtained on the PC boards were quite easy to decode once I figured out that the manufacturers were Avantek and Mini-Circuits Labs. Determining the manufacturer of the devices helped considerably in identifying their components, giving away further clues on how their component parts were labeled. The main problem lies in the fact that these are miniature components and cannot

contain a full part number. They have just a partial number and this must be used to recognize them. This isn't tough but it can be intimidating until you recognize the format. To become familiar with these part numbers you must browse through parts manuals in your field of interest to pick up subtle facts and store them in your memory for recall.

Avantek Parts

First, let's discuss a little about device package styles. Devices are available in a variety of case styles from leadless chips to high quality ceramic to low cost plastic packages. This case style in some instances takes into account the physical dimensions of the package, like the MSA-0685: The MSA-06 specifies the type of device; the "85" calls out a 0.085-inch plastic package. The various Avantek part numbers all have this simple format in common—the last two digits represent the case style. Until I understood this I was trying to keep a larger part number straight in my head and I was not having much luck trying to figure out that an MSA-0385 and an MSA-0386 were not too different at all, just case styles. I guess I got stuck on the old 2NXXXX and 1NXXX numbering schemes. Once I got this straight, it cleared up a lot in the MMIC amplifiers for me. See Table 1 for other package types.

There are still a few quirks in the labeling of devices but let's cover them one at a time. Avantek devices, both transistors and FETs, have a similar base part number. Transistors begin with the prefix "AT" and FETs begin with "ATF." Only the three-digit number following each is different. The last two digits reflect case style. In the case of MMIC amplifiers, the part number begins with MSA and has a four-digit part number. The first two identify the part

while the last two identify the case.

MMIC amplifiers can be supplied from the two different major suppliers, Avantek and Mini-Circuits Labs, but be careful—they are identical in specifications but differ in device orientation. The Avantek part is keyed on the output of the device with a dot or triangle imprinted or a dot depressed in the case, denoting output. The device number, such as "A-06," is also imprinted on the top.

The Mini-Circuits MMIC

The Mini-Circuits MMIC is printed with a color-coded dot on the input, opposite the Avantek orientation. Don't ask me why but that's the way it is. I suppose that Mini-Circuits wanted to differentiate the MMIC amplifier they sell from Avantek's. Just be careful to note which device you are working with. They do use different marking indicators so it's easy to tell them apart.

Surplus MMICs

What started all this was some surplus printed circuit boards that our group picked up. From the first, I thought all the devices on the PC board were MMIC amplifiers. However, once I consolidated the component markings with some common sense and a few catalogs, the identification process came together. Some of the devices I was able to scrounge off of these PC boards were the MSA-01, -02, -03 and -06 devices, all MMICs. The transistors were part number AT-414 and AT-420 devices.

The -01 devices are rated to 1,000 MHz while the -02 and -03 devices are rated to 2,000 MHz. Power gain runs from the 13 to 18 dB gain at 100 MHz to 12 dB at 1,000 MHz and 10 dB gain at 2,000 MHz. The noise figure runs in the 5 to 7 dB range with the -01 device having the 5 dB noise figure. The maximum power output for these devices runs from 0 dBm for the -01, to +3 dBm for the -02, and +8 dBm for the -03 device.

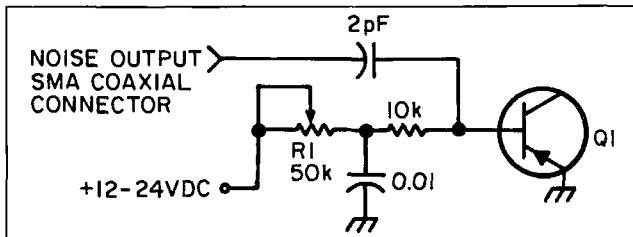


Figure 1. Noise head construction: transistor AT-42085 or any NPN device with high f_t . Set R1 for 1-2 mA current through the Q1 base emitter.

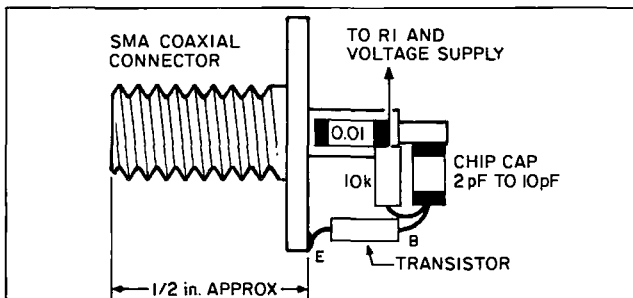


Figure 2. Parts placement method. For best high frequency noise operation, use a chip capacitor to couple the SMA pin, using the shortest possible lead lengths from the capacitor to the base and emitter to the ground.

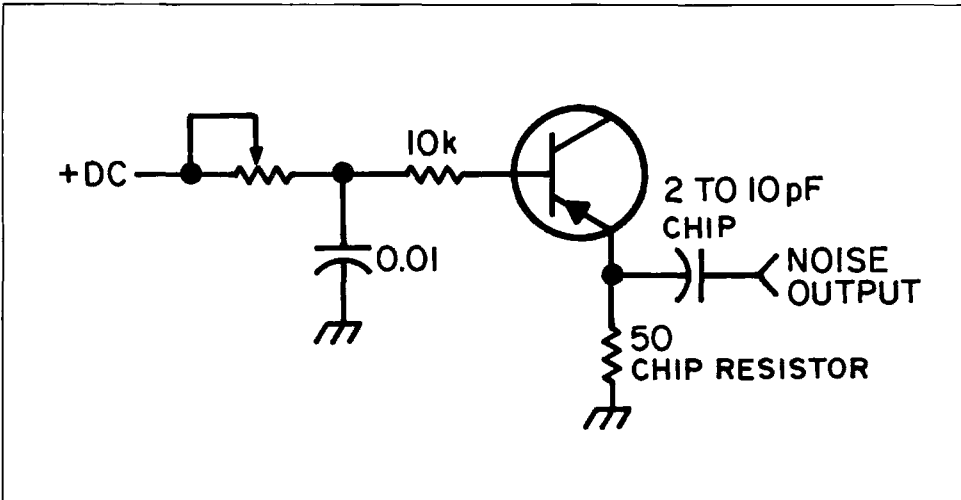


Figure 3. Possible alternative to the circuit shown in Figure 1 (see text).

I was pleasantly surprised to find that the -06 device (actually an MSA-0685) has 20 dB gain at 100 MHz and 11 dB gain at 2,000 MHz. The noise figure is 2.8 dB. Not bad for a broadband device, even with the output power limited to zero dBm. You just can't have high power and a low noise figure at the same time, with low cost. In any case, this -06 device should be quite good for general purpose amplifiers in low noise applications. Even at a 2.8 dB noise figure this should be quite suitable for many older radios serving as a broadband preamplifier. See my column in the April 1992 issue of 73 for other MMIC specifications for Mini-Circuit MMIC devices.

The A-414 and A-420 devices scrounged from the PC boards are bipolar transistors good to 6 GHz. The 414 device (AT-414) has a noise figure of 1.7 dB at 2 GHz and a device gain of 13 dB at 2 GHz. The 420 device (AT-420) is a little more husky, giving +20 dBm output power (that's 100 mW), a gain of 13 dB, and a noise figure of 1.9 dB, all at 2 GHz. Quite a device, especially from the junk box. One surprise is that I use the Avante AT-42086 transistor normally and don't know why I did not recognize it at first. My devices came in a tape reel and were upside down—that must have prevented me from associating them because of their orientation in the tape reel (at least that's the excuse I am using).

RF Noise Source/Generator

These 420 devices have been the mainstay for pet microwave projects in my shack for some time. I have used them for so many different projects and applications even I can't keep track of all of them. The most interesting and simple application that I used them for was a noise generator. This unit works from a low frequency of a few MHz up into the GHz range. The circuitry is quite simple and only requires a current-limiting resistor and chip capacitor for coupling. Only two leads of the transistor are used—the base emitter junction. The collector is left open.

The principle is that with forward current flowing through a junction, noise will be generated up to the "Frequency Total," or Ft, of the device. Since these devices are rated to 6 GHz they worked quite well into the several GHz range. This little project can be used to drive MMIC amplifiers to increase the power output. Why, you say? Well, noise generators can drive bandpass circuits with sufficient power and the output can be observed being indicative of its frequency response. This shaped noise can be displayed on a spectrum analyzer depicting bandpass vs. frequency. (A sweeper is not needed.) The noise generator and MMICs can complement one another.

The power supply is the only complicated thing in this entire project. It can be as simple as a 9-volt battery and regulator which will provide noise output whenever it is switched (turned on). A more complicated unit would be

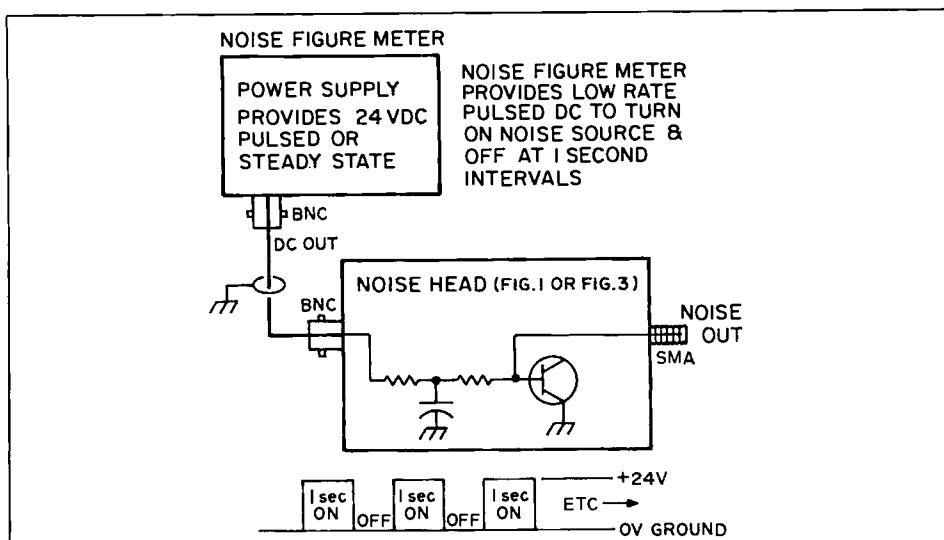


Figure 4. Noise head operation. If DC power is steady, noise output will be continuous. If DC power is pulsed, noise output will be pulsed. A pulsed noise source is useful to determine the difference between noise to no noise for the noise figure ratio.

composed of a power supply/battery that could be pulsed on and off at a set rate. This pulsing power supply is what really makes the noise source perform and is the most common method of operation. A noise figure test set normally provides all power supply functions for the noise head, as well as displaying the measured noise figure directly in dB. The test set additionally has circuitry to do all the computations to give you a display or readout of the actual noise figure.

A simple noise source similar to the one described this month for steady-state noise will work just as well without all the calibration accuracies of a conventional full-scale noise figure meter. All you have to do is read the difference in output of your receiver (noise source on and then off) and determine from the ratio of noise-to-noise just what your noise figure is. It's not complicated to figure out your noise figure, but you need not go through the math. With a noise source instead of a signal generator, tune your system for best noise performance and you're done. True, you don't know exactly how well it's working but it will perform better than if you tune it up with a signal generator.

In actual practice, it's easy to peak up your system's performance by using such a simple noise generator. Just adjust your preamp and RF stages in a receiver for maximum noise as detected on the output of your receiver. Don't start from scratch to do noise alignment this way—as stated before, your receiver must be operational first. The noise alignment method is used to peak or maximize the best performance, not to do a total alignment of a radio. See Figure 1 for the construction details of a simple AT-42086 noise generator RF head. It should be constructed with minimum lead length as the longer the lead length the lower the maximum frequency of operation will be.

To minimize lead length I chose to construct the noise generator on the

back of a miniature coaxial connector, an SMA type chassis connector. This connector is made to work with coaxial cable (solid shield 0.141-inch diameter) that is quite small in diameter. It is intended primarily for microwave operation and is good to 18 GHz. In our application, small is better as this helps to keep lead length to a minimum. This improved high frequency operation (in the GHz).

In normal operation a special noise diode is employed to do the function of generating noise. In our application we are replacing the diode with a base-emitter junction of a microwave transistor as they work quite well and cost a lot less. The circuit for the noise generator is quite simple and uses few parts. See Figure 2 for the component configuration to minimize on lead length. The basic circuit uses four parts: a coaxial connector, a chip capacitor, a chip resistor and the microwave transistor. To use the circuit, provide a source of DC power positive to the base of the transistor through a current-limiting resistor set to draw about 1 mA of current to start with. This resistor value will vary depending on your transistor. Normally, you should start with a high value resistance, say 50k ohms, and adjust lower until you read 1 mA of current. Maximum current should be no higher than a few milliamperes. I use a 24-volt power supply with two 10k resistors in series with my transistor and draw 2

milliamperes of current. The second 10k resistor originally was a pot for best adjustment but it works well with the fixed resistor for miniature size.

Figure 3 shows a modified circuit for better high frequency response. I haven't experimented with this circuit yet but it might be interesting to try. It is supposed to provide higher frequency noise output than Figure 2 by lifting the diode anode end (our emitter) from ground and terminating it in 50 ohms. The RF output is directly fed from this point. I prefer the first circuit (Figure 2) for DC isolation and simplicity reasons. The transistor used in either circuit is the Avante AT-42085, which has a frequency rating good to 6 GHz. If you can't locate a device, I will provide a kit of parts including several Avante transistors and the resistors and a chip capacitor. You will have to come up with your own coaxial connector. By the way, the SMA connector is not the only one that can be used; even a type "N" is suitable—it's larger but works quite well. Cost of the parts kit is \$7 post-paid. (Note that any microwave npn device will work in this circuit; it's the high frequency junction, base to emitter, that gets the job done here).

Well, that's it for this month. next month I plan to cover packaged mixers in general. As always I will be glad to answer questions concerning this and similar topics. Please include an SASE for a prompt response. 73 Chuck WB6IGP.

00	Chip only	Bare chip only
04	0.145 plastic	Low-cost plastic pk.
10	100 mil.	Hermetically-sealed hi-rel. pk.
11	SOT-143	Surface mount SOT-143 pk.
35	Micro-X	Moderate-cost microstrip
36	Micro-X	Cost effective microstrip
50	50 mil.	Hermetically-sealed hi-rel. pk.
70	70 mil.	Hermetically-sealed hi-rel. pk.
84	0.085 plastic	Low-cost plastic pk.
85	0.085 plastic	Low-cost plastic pk.
86	0.086 plastic	Low-cost surface mount pk.

Table 1. Package types and case styles (last two digits only) of Avante devices.

**(Update on last month's Update . . .
the saga continues.)**

Baby Loopy

Refer to the above article on page 34 of the October 1992 issue. The formula that reads

$$\frac{19 \text{ turns } (3.14)^2}{12 \text{ inches/ft}} = 9.94 \text{ feet}$$
 should read as

$\frac{19 \text{ turns (3.14) } 2}{12 \text{ inches/ft.}} = 9.94 \text{ feet.}$ The value of 2 is the coil diameter in inches.

A 2 Meter FET Amplifier for Your Handheld

Refer to the above article on page 20 of the October 1992 issue. The schematic diagram and the parts list shows the value for R5C1 and R5C2

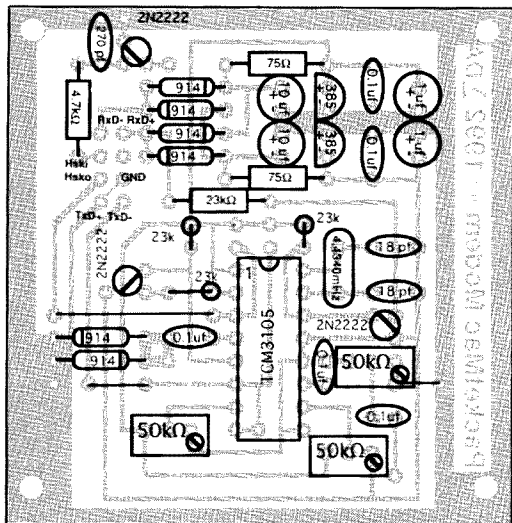


Figure 1. The corrected (and hopefully final) parts placement diagram of the Pack-
etMac Modem showing the jumper wires as well as the new pad assignments
(shown in red). Using these new pad assignments, just follow the wiring hookup
chart in Figure 4 in the original article for the proper connections.

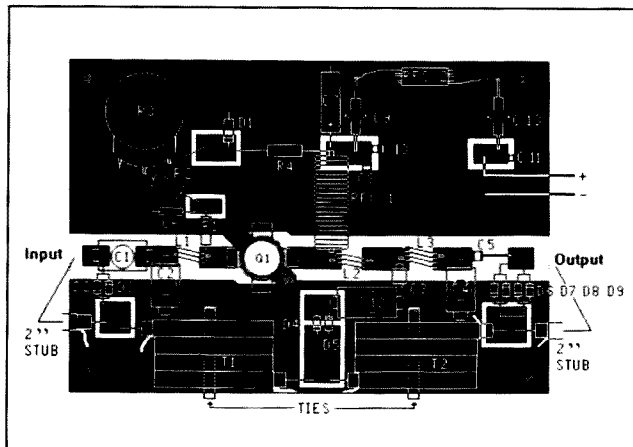


Figure 2. Updated parts placement diagram for "A 2 Meter FET Amplifier for Your HT." The MRF 137 transistor is configured in such a way that it will not fit readily on the PC board shown in the article. There are two ways to fix this. One is to bend the transistor leads and squeeze them through the mounting hole. A better approach is to cut away openings in the board at 45 degrees to the source and gate and at 45 degrees to the other source and drain as shown here. 1/4" wide by 3/8" long cutaways probably will be sufficient. Also note that if a chip cap is used for C5 on the board, a lead will have to be run from the cap to the foil in order to make a connection to the diodes.

reversed. RFC1 should be 20 turns of #16 wire, 0.3 inch diameter. RFC2 should be a 100 μ H choke.

The following changes to improve the amplifier's performance have been sent in by the author: The diodes on the output (D5 and D6) get hot; putting two other diodes in parallel with D5 and D6 will solve this problem and increase the power output. Communications Concepts, inc. is a source of many of the parts for this amplifier. You can reach them at 508 Millstone Dr., Xenia, OH 45385; Tel: (513) 426-8600. For C1 and C12, use an ARCO 406; For C2 and C4, use an ARCO 403 and 404 respectively. C3 calls for a 56 pF Unelco capacitor and C5 uses a 680 pF chip cap. Adding C13 (0.01 uF chip capacitor) in parallel with C8 appears

to improve the amplifier's performance. RFC2 can be replaced with a Ferroxcube VK-200-10/4B choke.

If you still cannot get the rated power out of the amplifier, try putting a 144 MHz signal into it. Adjust the trimmer capacitors and R3 for maximum output and record it. Then send a 148 MHz signal into the amplifier and repeat the procedure. If you get more power out at 148 MHz, then the amplifier is resonant above the 2 meter band. Try replacing L1 and L3 (or both) with coils that are a quarter-turn longer than the original ones. Keep experimenting until maximum power is obtained. Conversely, if you have more power output on 144 MHz, then you should shorten one of more of the above coils.

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73 Amateur Radio Today

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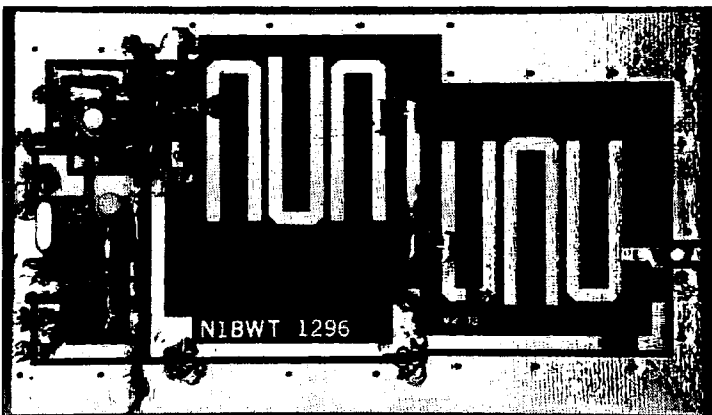
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NEVER SAY DIE

Wayne Green W2NSD/1



Learning Code Even Faster

The no-code license has doubled our newcomers, but this is only pulling off the misery. You still have to learn the code to get in on most of the fun amateur radio has to offer. So why not at least make the process as painless and as fast as possible?

My advice is to go for 20 wpm right off the bat. The weird fact is that it isn't any more difficult to learn the code at 20 wpm as it is at 5 wpm, so why multiply your aggravation? I sure wish I'd known about this when I was learning the code! Alas, I used the ARRL system, which was right out of the Dark Ages and provided a maximum of misery and a minimum of success. The upside, as far as many hams are concerned, is that this system alone was responsible for discouraging millions of potential hams from getting licenses.

We know a lot more about how the brain-mind-body system learns skills now than we did 50 years ago. Not that all this scientific data has perked through to most of the code learning systems, which are still firmly rooted in the 1920s. Now we're having people able to learn the code at 20 wpm within a few days—a skill that often used to take years.

Recent research at the Weizmann Institute of Science in Israel has shown that your best time for learning a skill such as copying code is to do it shortly before going to sleep at night. You do your practicing, and then you sleep on it. This lets the brain-mind-body integrate the skill faster. Experiments where people were awakened during the REM part of their sleep—while they were dreaming—slowed down the learning curve substantially. So go to sleep and dream.

How long should you practice? As long as it's fun. I'd recommend 20-minute sessions. As soon as it stops being fun and exciting, don't push it. Remember, you're building a new skill, one that will be with you for the rest of your life—one that will set you apart from people without that skill. You're learning a new language.

In case you've missed my explanation of how to go about learning the code, or have been too cheap to buy my 20 wpm practice tape, which comes with the instructions, here's the process. It's simple. Instead of learning the dit-dahs

of each letter and number and starting out at 5 wpm and gradually speeding up, you jump right in at 20 wpm and start listening for one single character—like an E. Even at 50 wpm you can hear the dit as an E goes by. Every time you hear that dit you write down an E. It won't take long for this to become fairly automatic. Once it's easy, you start listening for did-dits and writing down I's as well as E's, and gradually work your way through the alphabet, numbers and punctuation.

The old system, where you learn all the characters first and then look them up in your mind when you hear a sound pattern, keeps your brain busy shuffling between the two halves of your brain—one which recognizes the sound pattern and the other with that look-up table of characters. This works pretty well until you get to about 10 wpm when you've reached the clock speed of the brain, if I may use the computer analogy. That's the famed plateau, hanging in there just under 13 wpm. So near, yet so far. Unfortunately, no amount of sweat and strain can change this. You just have to start all over and learn the code the way you should have in the first place—weeks or months ago. Years in some cases.

What you're going to do is build a new motor skill, like typing or playing the piano. Only this time it's you writing or typing code characters as they zip by. You hear the sound, your fingers move. Good high speed ops can copy code in their heads while talking with someone, it's so automatic.

I'd recommend you get my 20 wpm practice tape, but I'm sure some crummy nit-pickers would complain that I'm going commercial. Mine is inexpensive, it's a fiendishly-planned class-A bitch to copy, and it'll do the job. You sure aren't going to memorize this baby.

We're ABC!

Oh whee and big deal. Well, it's a big deal for 73, now that we've had our circulation audited and our sworn claims verified by the Audit Bureau of Circulation. Rough talk to deal with. But frankly, I got tired of what I've believed to be total baloney sworn circulation claims by some ham magazines I could mention. As it turns out, ABC certified our 1991 circulation at several thousand more than we reported ourselves.

In almost any other industry advertisers and their agencies understand that unless a magazine's circulation has been audited and certified, there's little chance that the sworn claims are even in the same ballpark as reality. You have to remember that advertising is normally charged on the basis of so many dollars per thousand paid readers, so the more the publication lies, the more money they make. And money does odd things to people.

It's all the worse when one magazine claims double or even triple its actual paid circulation, while another plays it straight. Honestly just isn't the best policy when your competitor is lying and his lies can put you out of business. That's where ABC comes in for most industries. They make a magazine prove every claimed paid reader. Their accountants come in and go over every record with a fine-toothed comb. But the end result for advertisers is the knowledge that the certified circulation is really true.

About the only reason for a publication not to be certified these days is that a close look at their figures would prove them false, so reputable advertising agencies tend to avoid doing business with them.

In the amateur radio field, 73 is the only magazine which has been certified by ABC.

I remember the first time I discovered how wild the circulation exaggerations could be in this field. I was the editor of CQ at the time. My assistant editor slipped into the CQ offices one night and made a copy of the actual circulation figures and brought it to my house. I was astounded. The actual paid circulation was less than half what I'd been told and what the notarized sworn statements claimed. We were charging over double what we should have for our ads.

The next day I found out that after giving me the figures my assistant editor had gone to the publisher and told him I had the actual circulation figures. He expected, correctly, that I'd get fired and he'd be the new editor. The publisher assumed I'd taken records, so the next morning he demanded I return them. He drove me to my house, picked them up, and fired me. He was terrified that he might be sent to prison for falsely sworn statements.

I was surprised, but not dismayed, at being fired. CQ was raking it in, turning

a profit of well over a million dollars a year in today's dollarettes . . . mainly because of the bogus circulation claims . . . and I was getting bupkis. Oh, I'd been promised that if I pulled the magazine out of the red I'd share in the profits. Well, I did. For Christmas that year I got a \$5 bonus, and then I was fired a few days later. That was my share of the profits.

The magazine had been stiffing the authors. They were at least a year behind on paying every author I checked on, and over a year and a half on most columnists. I had to pay for articles out of my pocket in order to get them. When I was fired they owed me over \$10,000 in 1960 dollars . . . around \$100,000 today. The publisher promised to repay the loans. I'm still waiting.

That circulation scam worked so well for the publisher that after I'd been fired he sent out sworn statements for about three times the actual paid circulation . . . and advertisers were stupidly paying up.

After getting fired I tried working for an advertising agency. I found this really wasn't what I wanted to do. My hobby was amateur radio, so what better to do than publish a ham magazine? That was *fun*, so I started 73, even though I only had just barely enough money to print the first issue. It was one heck of a gamble. CQ was telling the industry not to advertise in 73 because it would soon fail. Fortunately, not all advertisers believed them, so I made it.

I started out doing everything. I solicited manuscripts, edited them, took the photos, sold the advertising, went to hamfests to sell subscriptions, got the magazine into over 850 ham stores with the help of Jim Morrisett WA6EUX (now K6MH), wrapped 850 bundles of magazines every month and mailed them, cut stencils for new subscribers, printed thousands of magazine wrappers for the subscriber copies, sent out the invoices for advertising and store copies, made the bank deposits, kept the books, and so on. It was a lot of work, but I made it go, despite everything CQ was doing to stop me.

In addition to all that I was the president of the Porsche Club, organizing car rallies, helped found American Mensa, helped organize the ARRL New York convention, and was doing my best to cope with a sick wife. 1960 was a busy year. Heck, I was almost as busy then as I am now, over 30 years later.

It'll be interesting to see if 73 being audited by ABC will encourage the other ham magazines to get their circulation figures certified . . . or if advertisers, seeing that they may have been paying for phantom circulation, start demanding audits.

Audited magazines that don't provide the promised paid circulation have to refund advertisers for the shortage. Of course I have no way of knowing for sure if any of the other ham rags are shortchanging the advertisers, or by how much; but when advertisers in 73 tell me their identical ads in another magazine are selling only half as much of their

Continued on page 74

LETTERS

Number 2 on your Feedback card

From the Hamshack

Richard Ashley NS1ZC, Salt Lake City UT Just yesterday I was driving south on Interstate 15 about 35 miles south of Salt Lake City when I had to pull off the highway because of a minor mechanical problem. Within a few minutes a Utah Highway Patrol car pulled in behind me and offered assistance. However, he also took note that my vehicle was registered in Texas and I was not from here. I'm only a temporary resident. After determining my problem the patrolman took close note of my ICOM IC-02AT handheld, my Yaesu HF rig and my ICOM 2 meter mobile rig. The mere appearance of these radios in my vehicle really agitated the patrolman and he literally demanded to know why I had three "scanner radios" in my vehicle! I explained what the radios were and that I was an amateur operator. He flatly refused to believe that and, to top it off, he was going to confiscate my equipment unless I could provide my original license! I explained to him that my "original" was framed on my wall back home in Texas and offered him a copy. That was not sufficient. He believed that anyone with "sophisticated" radio gear was a dope runner or involved in some sort of criminal activity, and made no qualms about being quite vocal about it. I have never been accosted like this by any law enforcement officer, and it was only after I spent over an hour sitting in his cruiser being checked out that I was allowed to finish my Thanksgiving Day journey.

It seems to me that the amateur community should make the law enforcement community more aware of mobile amateur activities and the help they can provide. I may further add that I have made a written report to the officer's superiors here in Salt Lake City. I would be curious to know if this is just an isolated incident, or has this or anything similar happened to other amateurs?

Arnold Samuels, Ocean Shores WA Wayne, as I read your "Never Say Die" column religiously, I see you always refer to the amateur radio service as a "hobby." As a hobby, I see no reason why the U.S. taxpayer should support us; as a service, it should. I never see the FCC refer to us as a hobby—why do you? It is high time you change your attitude and start calling this hobby a service, which it rightfully is.

Arnold—You'll find that I am pretty careful about the words I use. Amateur radio is a "service" only because of the hobby it provides. The sorry fact is that very few hams are willing to spend much of their time providing service. Somewhere around 99.9% are rag-chewing, working DX, contesting, mangling useless traffic, jamming nets, certificate hunting, and kerchunking repeaters. Some service.

Of course, as you say, the FCC refers to amateur radio as a service. This is an enormous lie and most of the people at the FCC know it. What we have, in fact, is a government-

sponsored entertainment medium mainly of interest to middle-class older white American males and to Japanese youngsters, which allows a very select few of us to use tens of billions of dollars in public frequencies.

On rare (and getting rarer) occasions we're able to provide emergency communications, but with the popularity of cellular phones, our help is being needed less and less. We've contributed pathetically little in technical developments in the last 30 years. We no longer can supply technically skilled operators for the military in time of war as we did during WWII, when 80% of the hams joined the services. Of course, that was before the hobby went geriatric.

Service? Oh sure. Cheers . . . Wayne

Carlos M. Herrera N2OIZ, North Bayshore NY I just received my subscription-ending December issue—subscription-ending because I thought I wouldn't be able to afford to renew due to my current financial condition. So I read your editorial, which is always the first thing I read in 73. Well, I'll be signing on again and I think I have a simple solution to increase both subscriptions and readership.

I am not only going to renew, but one of my ham friends will be getting a gift subscription this Christmas. Now, if every subscriber you currently have does the same for one of their friends or relations you'd see a definite increase in readership, ergo more interest by the big advertisers. If your current subscribers can't bring themselves to think of a worthy soul maybe they can give a gift subscription to their local library (which probably can't afford it) or to a ham club in a local school. There might even be a tax benefit (for the real skintails!)

Last point: You're right (again). With all the interest in ham radio there's got to be some way to make a decent living at it. I intend to find it (or them). Wayne, thanks for the inspiring words: Never Say Die!

Bill Roork VE3MBF, Agincourt, Ontario, Canada Wayne, I look forward each month to reading your editorials. As far as I am concerned, you make more sense than the rest of the ham magazines put together.

I particularly want to congratulate you for mentioning the book about electromagnetic fields (November 1992). After reading just part of that book, I am convinced there is a serious problem, one which we no doubt will be hearing about a lot more.

As a member of the Scarborough Amateur Radio Club, I am the educational coordinator. We offer "Code and Theory" classes each year as part of our effort to help save amateur radio. We use a system which is unique in our area. Instead of having one person teach all the lessons, we use a different Instructor each week. All instructors are members of the club and donate their services without remuneration.

We find that because each instructor appears only once, they go to great lengths to prepare their lecture and, most importantly, they bring in many, many exhibits (resistors, capacitors, diodes, lubes, transistors, coax, transformers, etc.) to illustrate the subject of the evening.

We have two public events per year where we promote amateur radio. One is at a large local shopping mall in the spring. We have a table display, exhibits and signs, plus a working rig to show. We encourage those interested to join our "Code and Theory" class which starts in September. We get quite a few prospects.

Our other major effort is one day (usually a Sunday) at the Canadian National Exhibition in Toronto. This occurs in August, and there is an amateur radio station (VE3CNE) where a local amateur radio dealer loans a number of transceivers, keys, paddles, tuners and computers to demonstrate packet radio. The antenna system at the VE3CNE station is the property of the station, funded by contributions of metro area ARCs. Since all the metro area clubs participate in the CNE program, amateur radio in the area gets quite good exposure (several million people per year) and we all get cards signed by interested people of all ages.

Over the last four years, our club has had in excess of 160 people join and go through our class. The pass rate has been very high, with many people getting an amateur radio license.

So far as the "Code and Theory" classes are concerned, there is one problem. That is, that while the code is still a requirement for full licensing, it is becoming increasingly difficult to purchase straight keys and code practice oscillators at a reasonable cost. The best we have been able to do is to show the students how to make a very inexpensive code practice oscillator using the following: a straight key, a wood block, a 9-volt battery, a piezo-electric buzzer (Radio Shack or other) and two feet of wire for connecting. Thus, for about \$12, one can build a quite usable code practice oscillator, provided a straight key at a reasonable price (say, \$7) can be found.

In view of the fact that the licensing structure requires Morse code at 12 wpm to gain access to all amateur radio frequencies, we really stress that all students should learn the code. We furnish a cassette tape with computer-generated code at 6, 8, 10 and 12 wpm as a starter. As you have often pointed out, it seems ludicrous that we require people to learn an obsolete discipline like CW so they can be fully licensed—while at the same time the licensing structure almost ignores the important DIGITAL technology, where future development appears to be heading.

You have proved repeatedly that you are a clear thinker with many constructive and innovative ideas. As one old geezer to another, I take my hat off to you for your comments on education, effective government, entrepreneurial opportunities and many other subjects. I hope you will be able to publish your common sense ideas for a long time. As a former Olympic and pro ice hockey official, minor hockey coach, engineer, multi-plant

manager and consulting engineer, I find that you are one of my very favorite people.

John Beegan, Streamwood IL I started in radio as a Cub Scout and built a crystal radio with the help of an older student. I still remember how fascinated I was to hear real radio coming out of the headphones. And no battery or wires plugged into the wall socket!

Later, I built a Meisner kit radio which had several tuning coils for various bands. I kept this radio through high school and left it to the science department of the school. Building and soldering and making connections, reaming holes in an aluminum chassis, inserting grommets—it was all fun.

One time I was building a radio that required a battery for power. I made all the connections and checked them. The radio would not work. I asked my dad and he said to re-check everything. I did; it still did not work. Finally, I went to the next-door neighbor, Mr. Miller, who was a bus driver. Mr. Miller looked at my breadboard, looked at the schematics, and said, "This damn thing will never work, the way they got it." He then advised where a connection had to be made (or where a connection was called for that should not have been indicated), and of course, then it worked. Mr. Miller had studied radio and TV repair, and did a "moonlight business" out of his basement, fixing TVs for the neighbors.

It was from Mr. Miller that I learned that the book is not always right. Sometimes the experts know more than the guy who wrote the book. That's why I am writing you. I am a police officer, and the "official" version is: "Radar won't hurt you." I picked up 73 and read your review (November 1992) of *WARNING: The Electricity Around You May Be Hazardous to Your Health* by Ellen Sugarman. As you so correctly pointed out, electrical fields can have an effect on living tissue. That's why they use X-rays for treatment of certain medical conditions.

At present, every American is exposed to high-tension wires, and to scatter radiation from TVs, radios, microwave ovens, electric blankets and police radar. Virtually every motorist in almost every metropolitan community is being dosed with radiation from radar guns. All of this in the name of the law, of course. And to add insult to injury, the citizens themselves are taxed in order to pay for the radar that is then used on them. Additionally, there have been several court cases where police officers have alleged that they have suffered serious effects from the use of the police radar—serious effects like cancer.

Of course, there is an alternative. Laser guns that measure traffic speed have been produced and are already on the market. The drawback is cost. The laser guns cost more than the radar units. It also appears that the laser guns are much less likely to be abused or misused than radar guns because they are more precise.

Don't let up. Keep putting out a strong signal, and let the world know. Most people will eventually take the message to the polls. Politicians who do not listen need to be replaced. It's happened before, and it will happen again.

Canadian Amateur Radio Organizations to Merge

Executives of Canada's two amateur radio organizations met in Cobourg, Ontario, on October 3, 1992, to iron out the details of their merger. The new organization, to be known as Radio Amateurs of Canada, is comprised of the members of the Canadian Radio Relay League and the Canadian Amateur Radio Federation. In addition to reviewing the complex legal issues involved in such a merger, the delegates from CRRL and CARF also affirmed maintaining a Canadian national field organization, established a committee to study the national Capital Region headquarters office, reviewed a proposed Radio Amateurs of Canada operating budget, and affirmed that all former CRRL and CARF members will continue as RAC members with all services. *Via ARRL Letter. TNX Westlink Report #638, November 27, 1992.*

Cosmonauts to Fly on the US Space Shuttle

Cosmonauts Sergei Krikalev U5MIR and Vladimir Titov have been selected to fly on the US Space Shuttle next year. Both cosmonauts will be arriving in Houston shortly to begin their training. At this time, it appears that Titov will be trained as a back-up in the event Sergei cannot fly on this mission. There has been no word whether U5MIR will operate SAREX amateur radio equipment from the Shuttle as he has from the Russian space station *Mir* in the past. *TNX KD2BD; W5YI Report, Vol. 14, Issue #20, October 1, 1992.*

Earthwinds Setback

The Earthwinds attempt to circumnavigate the world nonstop in a manned capsule suspended between two special balloons suffered a setback just days before a scheduled liftoff. During a media tour of the launchsite near Reno, Nevada, a 29 mph wind gust ripped a hole in the top of the large inflatable dome that served as a hangar for the project. The dome quickly deflated, exposing the 100-foot-diameter anchor balloon (already inflated in preparation for liftoff) to the high winds. The anchor balloon broke free from its moorings and rolled nearly a quarter mile across the desert floor until it deflated after suffering damage from the sagebrush. Fortunately, no one was hurt and the gondola only experienced minor damage. The top balloon was still in its packing

crate and was undamaged.

The anchor balloon will have to be either repaired or replaced. In addition, a new hangar dome will have to be installed. It is expected that repairs should be completed in time for a possible launch in early January 1993. This still gives the Earthwinds crew a two-month launch window.

During this historic flight look for the ham radio tracking experiment on 28.303 MHz. At 30 and 55 minutes past each hour there will be a transmission giving the balloon's latitude, longitude and ground speed during the flight. The callsign will be KB7JGM. *TNX to Bill Armstrong and Erin Porter of the Earthwinds Hilton project for the above information.*

Ban on Cellular Scanners Signed

President George Bush has signed into law legislation that blocks the sale of radio equipment used to eavesdrop on cellular telephone calls. It directs the FCC to withhold its equipment authorization for any radio scanner that can receive cellular frequencies or that can easily be modified to receive such frequencies. The equipment cannot be sold without FCC authorization.

In about a year the law will also make it illegal to manufacture this type of equipment in the United States or import any such equipment made elsewhere. *TNX N7EP; Westlink Report, Number 639, December 10, 1992.*

Hams Aid in the Wake of Killer Tornadoes

Ham radio operators from throughout the South have rallied forces to aid victims of a series of devastating tornadoes that ripped through Mississippi, Tennessee and Alabama on Saturday night, November 21, 1992, and Sunday morning, November 22nd. At least 16 people were killed, with countless others injured and homeless.

All but one of the fatalities occurred in Mississippi Saturday night. At least six died when a tornado hit a trailer park in Brandon. The other reported death occurred in Toone, Tennessee.

The storm knocked out power to many homes in Rankin County, Mississippi, near Jackson. Also disrupted were many normal lines of communications, including telephone and cellular telephone service. At least one 2 meter repeater was damaged and knocked off the air, but most others

survived unscathed and were pressed into immediate relief operations service.

With the traditional communications services taken out, hams accompanied rescue workers who used doors from ripped-apart trailers as makeshift stretchers to move away the injured, according to a civil defense official.

In western Alabama, Danny Buford KC4RLR spent the following day in Ethelsville, which was also hit by a severe twister. Buford used his amateur radio gear to help assess damage for the Red Cross. According to KC4RLR, he saw at least three homes that were destroyed and many house trailers damaged beyond repair. Buford said that it was all but a miracle that nobody was killed in Ethelsville, where seven people were hospitalized.

Amateurs involved in "Skywarn" severe weather spotting nets stayed on the job overnight. They were reported to have seen a tornado touch down about 11 p.m. and reported it and other critical storm information to authorities via 2 meter FM. The National Weather Service confirmed the sightings on Sunday the 22nd, noting that this help may have kept the death toll from growing higher. *Westlink Report's* Youth Editor Sam Garrett AAØCR and 1992 *Westlink Report* Young Ham of the Year Angie Fischer KBØHXY were written up in the St. Louis, Missouri, newspapers for their participation in Skywarn operations.

Earlier Saturday, tornadoes caused serious damage and several injuries in parts of southeastern Texas. Skywarn hams also reported that a tornado touched down in southern Iowa as well, causing several minor injuries. And in Ohio, members of the Dayton Amateur Radio Association took the DARA Emergency van to a suburb of that city after a twister touched down, causing minor damage on Monday November 23rd. *TNX KB4KCH, N8FPF, NØDN and others; Westlink Report, Number 639, December 10, 1992.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at 73 Magazine, Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one stop bit. News items that don't make it into 73 are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327.

Fun at 10,000 MHz

Explore the wide open spaces of the 10 GHz microwave band.

by Gordon West WB6NOA

The 10 GHz band has plenty of elbow room for activity—would you believe 500 MHz wide? And on any warm weekend you can usually find plenty of activity on 10 GHz if you take a little drive to the local hill or a mountaintop.

There are two companies that manufacture 10 GHz systems: Advanced Receiver Research Company (wideband FM transceivers), P. O. Box 1242, Burlington CT 06013, (203) 582-9409; and SSB Electronic USA (narrowband SSB/CW transverters), 124 Cherrywood Drive, Mountaintop PA 18707, (717) 868-5643.

For local contacts out to 100 miles line of sight, wideband FM works great at 10 GHz. The Advanced Receiver Research transceiver is completely assembled and is ready to go for voice, MCW, video, or data. You could run up to 100 mW output with a M/A-COM Gunnplexer, part of the \$500 TR-10GA transceiver system. Just add 12 volts and a simple Radio Shack mike and you are on the air, full duplex, into a little plastic horn antenna that points in the direction of the other microwave station. For just about a grand you could get on the air INSTANTLY with the two ARR transceiver systems. On a hot summer afternoon you could probably exceed 100 miles of communications range due to the atmospheric condition called tropospheric ducting. The higher you go in frequency, the more pronounced the tropospheric duct gets, and the further you can communicate. My best range with the ARR system was 245 miles from Southern California down into Baja California.

Avid microwavers have not been content to work only out to a couple of hundred miles. They wanted a 300- to 400-mile range, so they switched from wideband FM over to SSB, and as soon as a few SSB 10 GHz systems were on the air, contacts were achieved well beyond 300 miles.

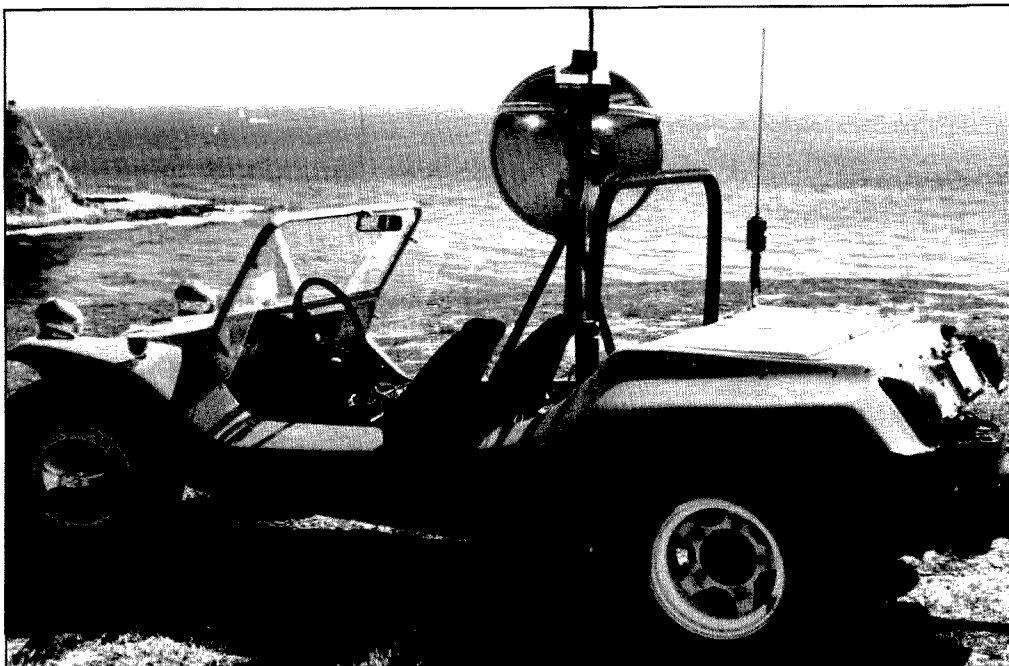


Photo A. The ARR 10 GHz FM system makes an ideal mobile microwave station.

The SSB Electronic USA Station

Fortunately there is a way to easily build a portable SSB or CW station for the 10 GHz band using the modules and components available from SSB Electronic USA.

A typical station would consist of the following:

- XLO-1 local oscillator module
- XTM-1 10.368 GHz transmit upconverter
- XRM-1 10.368 GHz receive downconverter
- HP-8761 single-pole, double-throw, SMA RF switch (or equivalent)
- SMA to 10 GHz waveguide adapter
- Control relay
- Output TR relay
- Multimode 2 meter transceiver

The XLO-1 local oscillator module puts 5 mW on 2556 MHz. A fifth overtone crystal at 106.5 MHz is used in the temperature-compensated oscillator circuit, and all multiplier stages are filter-coupled in order to achieve a clean output.

The XTM-1 transmit mixer requires a LO injection signal of approximately 5 mW at 10.224 GHz. We set the on-board attenuator



Photo B. A completely portable 10 GHz SSB station (200 mW output) can be easily assembled through the use of the SSB Electronic USA 10 GHz transverter, a 2m multimode rig and a horn (or dish) antenna.

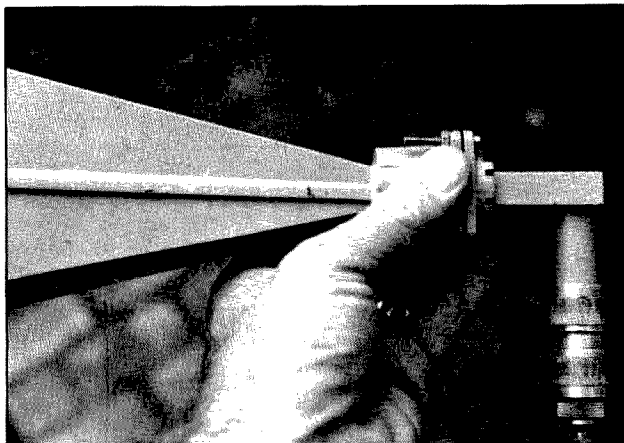


Photo C. A horn antenna is a good choice for portable 10 GHz operation. It can be easily fed with a waveguide-to-N-connector section. Standard coax adaptors reduce the feedpoint to an SMA connector.

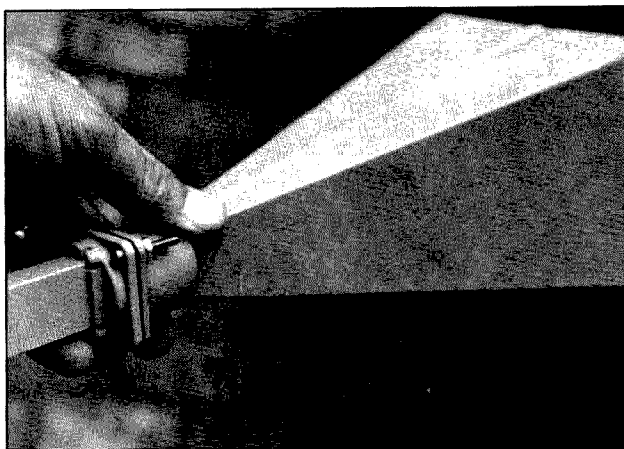


Photo D. The 10 GHz horn antenna is easily bolted to the waveguide flange.

to approximately 100 mW of IF drive from a modified Kenwood, Yaesu or ICOM 2m SSB transceiver. (The transceiver needs to be modified to cut out the PA section in order to limit power output to no more than 100 mW.)

An active GaAsFET mixer is utilized to provide a sum and difference output of 10.224 GHz, plus or minus 144 MHz IF input. The summed output of the mixer is selected by an on-board cavity filter tuned to 10.368 GHz. The resulting signal is amplified to approximately 200 mW output by a three-cavity coupled GaAsFET amplifier stage. That's right, folks, a whopping 200 mW output!

The XRM-1 receive module contains a mixer for an injection signal of approximately 5 mW at 2556 MHz. A separate SMA connector is provided for low output at 10.224 GHz for transmit mixer operation. Received signals are amplified by a two-stage, low-noise GaAsFET preamp with a noise figure of about 2. A cavity filter follows the preamp to provide filtering. A mixer is used to provide IF output at 144 MHz, going to your multimode transceiver.

Assembly

I chose the Kenwood 751 multimode transceiver because it was easy to cut out the PA section for an almost perfect 100 mW output. My thanks to Craig Martin at Kenwood for the documentation to insure no output spikes. On the back of the Kenwood 751 is a jack connected to an internal PTT relay, and this allows me to control the 10 GHz transverter for a simple push-to-talk operation. You must make absolutely sure you don't lose your PTT circuit to the transverter—transmitting while the transverter is still on receive would mean immediate destruction of the receive module.

RF switching is accomplished with an expensive HP SMA 12-volt RF relay. You can find plenty of 28-volt relays at the swap meet, and this is an alternate way to go if you can't locate a 12-volt relay with SMA connectors. You will then need to convert from the SMA jack over to an N-connector, or directly to the 10 GHz wave guide that will match up with your 10 GHz horn or dish. I run a horn and also have an optional

two-foot and four-foot dish from Anixter Mark.

The modules are completely pre-tested and pre-assembled inside their rectangular silver cans. Jerry at SSB Electronic USA relies on the hams to do their own setup of the individual modules. Jerry indicates it's a weekend job, and most of the time will be spent in "plumbing" all of the components together to match his suggested layout.

The total component cost for my entire system, INCLUDING THE 2 METER MULTIMODE TRANSCEIVER, was a little over \$1,000—exactly twice the amount of a pre-assembled wideband FM transceiver. There was also several days time spent in putting everything together, testing, tuning, and tracking down some of those illusive RF relays.

Performance

Once the system gets turned on and warmed up, stability is rock-solid. I tuned into several 10 GHz CW beacons, and after warm-up there was no noticeable drift. The beacons are an excellent way to double-



Photo E. Close-up of the "plumbing" to the SMA 12-volt relay.

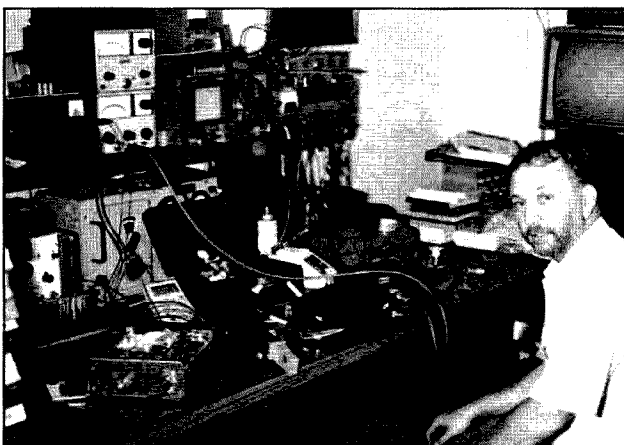


Photo F. Jim Ford N6JF measured over 210 mW output on 10 GHz using the SSB Electronic USA transverter (shown on the lower left of the workbench).

check that your receive system is up and running properly.

For transmit, output at 205 mW was confirmed with some elaborate waveguide tap-off equipment, but was confirmed using a simple microwave leak detector available from Radio Shack. Holding the microwave leak detector near the dish or horn aperture revealed plenty of energy coming out of the system. While the little Radio Shack microwave oven leak detector is not very scientific, it was the best thing going during the recent microwave contest when no one else up on the mountaintop had any real way of knowing that their system was up to par.

Our first contact was with Bill Alber WA6CAX over a path of 305 miles between Southern California and Arizona. He assembled his own SSB Electronic USA system, but opted for manual switching between TX and RX. We both used Anixter Mark two-foot dishes, and we had signal strength to spare.

We found that we could bounce the 10 GHz SSB signals off of passing aircraft, too. After all, 10 GHz is where most marine radars work. It was interesting to hear the Doppler shift as the aircraft was approaching both our stations.

So if you're looking for new frontiers to explore, and want plenty of elbow room, do consider the 10 GHz band. On any warm weekend there may be as many as 20 or 30 operators in your area participating in some mountaintop activity. Use a separate 2 meter transceiver for coordinating your contacts, or switch over to a relatively small horn, point in the general direction of suspected activity, and tune around looking for a signal. You might be surprised at what you hear!

Presently Southern California ham radio operators have their sights on setting a new 10 GHz SSB record between California and Hawaii, with Paul Lieb KH6HME up and

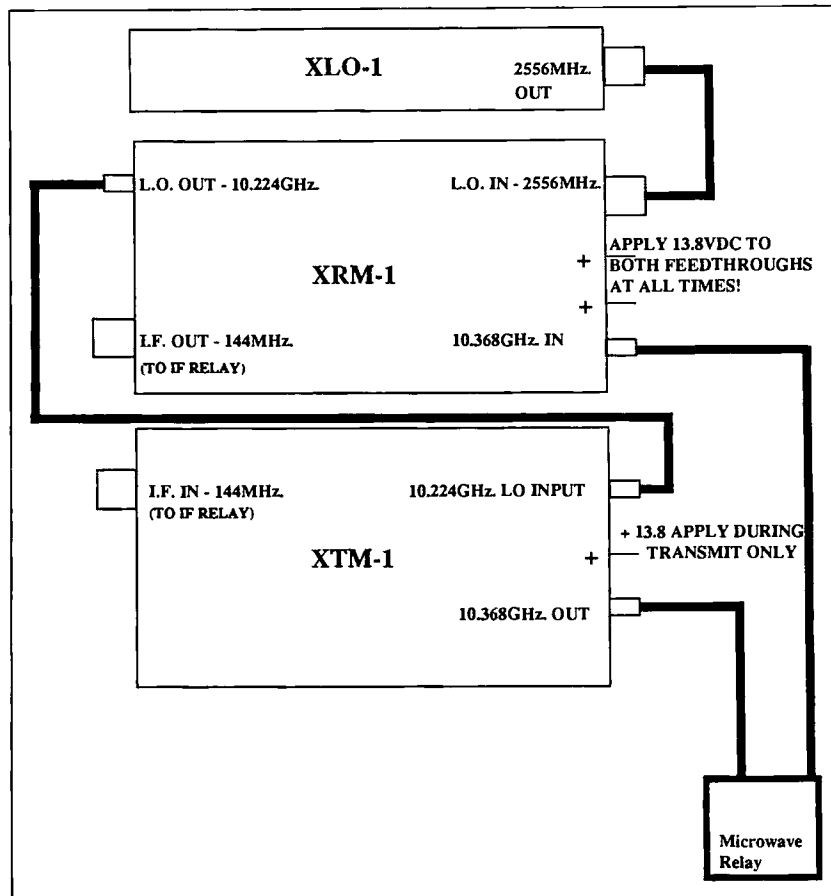


Figure 1. 10 GHz transverter interconnect diagram. Courtesy of SSB Electronic USA.

running with 10 GHz equipment. While 10 GHz "experts" say it can't be done at the 200 mW level, time will tell! The right conditions could open up a 10,000 MHz path

like no one has ever suspected before.

Come on up to 10 GHz—there's plenty of elbow room, and there's no shortage of pre-assembled equipment.

Build a Super-Horn Antenna for 10 GHz

With the concept that bigger antennas have more gain, I thought it would be fun to develop and build a 10 GHz horn antenna with a lot of gain . . . one that would just fit into my station wagon for mobile microwave use.

From the 10 GHz antenna bible, the *RSGB VHF/UHF Manual*, I found a passage which described a horn antenna as a "Waveguide feed appropriate to the frequency (WR-90 waveguide) which is smoothly flared in both planes so that a wave inside the guide horn can expand in an orderly manne . . ." In other words, take the usual 10 GHz horn and extend its sides in both the vertical and horizontal planes.

The formula is: $4\pi AB/\lambda^2$
(where A & B are the final aperture dimensions). Figure 2 describes the shape of the horn.

Construction

The local metal shop at the college that I teach ham classes at came up with some 5052 aluminum sheet. At 0.062" thick, it's just rigid

enough to hold its shape out to an exit opening of about three feet on a side—just enough room to fit into my station wagon's rear hatch opening.

We fabricated two sheets of aluminum into shape using a pattern press break for nice tight corners. We then manipulated both sections into place for a perfect extension of a small 10 GHz horn that gave us good results in earlier tests. We confirmed our measurements using the RSGB formula (see above).

The next step in the fabrication of the super horn was to heli-arc the two halves together at 10,000 degrees, using 5356 welding stock. Sanding cleaned up the joints for a smooth finish on the inside surfaces. We held our breath to make sure the entire horn would keep its shape without distorting under its own weight. It held up fine with little warp.

We attached a waveguide feed assembly, patterned after our small-horn sample. A small file gave us an almost perfect match to the WR-90

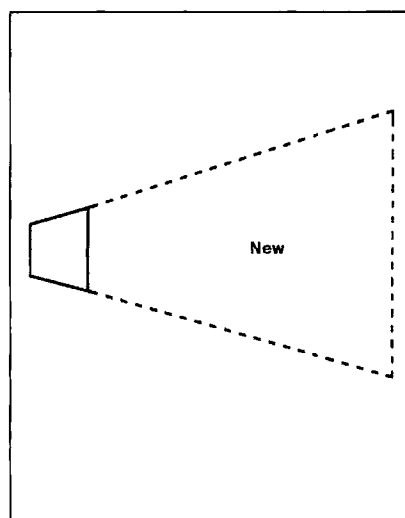


Figure 2. Dimensions and calculations for the 10 GHz Super Horn antenna. The horn formula appeared in the *RSGB VHF/UHF manual*.

Continued on page 77

The 23-Foot Indoor Antenna

Make an effective 20 and 80 meter apartment-dweller antenna.

by Richard Q. Marris G2BZQ

Relocating into an apartment for the first time can have a very traumatic effect. This, of course, also applies to any other habitation where an HF outdoor antenna is not permitted or is physically impossible to erect.

This first happened to me (licensed for too many years to remember how many) when, over 30 years ago, new employment meant moving the QTH at regular intervals, and turned me into an apartment dweller. Since then I've tried and evolved many apartment antenna types, including loops and helicals.

My Solution

With just 23 feet of wire across a room, it is possible to quickly get onto 20 and 80 meters in a minimum of time and at minimum cost.

In each successive QTH move, the good old 23 feet of wire has always been used first, to get G2BZQ back on the air again within a few hours of taking up the new residence.

Figure 1 shows the 20 meter version, and Figure 2 that for 80 meters. Note that the same 23 feet of wire (A-B) is used for both bands. Assuming that your transceiver can be placed in the corner of a room, A-B will consist of a drop down of about four feet to your rig, and the remaining 19 feet will be hung horizontally diagonally across the room, at least 9" below the ceiling. White PVC covered stranded hookup wire (#22 gauge—Radio Shack #278-1218) should be used as it is inconspicuous against a white ceiling. It should be supported by nylon fishing line which is also inconspicuous.

This antenna should be kept away from electrical wiring, water pipes, etc. Terminate with a small plastic ring at point B, leaving about 2" of bare wire hanging down. Support the plastic ring to the room corner with 10 lbs. breaking strain nylon fishing line. At the other corner of the room, support the wire to that corner with fishing line, leaving a drop down at A (about four feet), which is near the transceiver. This is the 23-foot antenna!

For 20 Meters

See Figure 1. As an antenna wire is increased in length above $1/4$ wavelength long, the terminal impedance increases to a

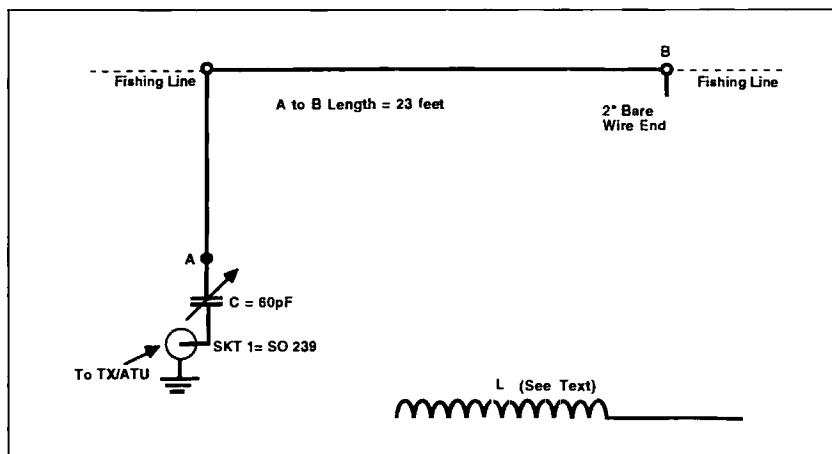


Figure 1. A 23-foot indoor antenna for 20 meters: 1a) 20 meter antenna; 1b) 20 meter helical ground.

point where the impedance reaches 50 ohms. Unfortunately, at the same time the reactance has also increased, but can be tuned out with a series capacitor (C in Figure 1a). This variable capacitor should be a good quality ceramic type, of equivalent size to that in your transmitter's PA. It should be mounted in a plastic box with a large diameter plastic instrument knob. Coaxial socket SKT1 can be connected to a 50-ohm output having a pi network output, using a short length of RG58 feedline. Better still, an existing 20 meter antenna tuner (ATU) can be inserted between SKT1 and the rig. This will help eliminate TVI.

For 80 Meters

Figure 2 shows that the same 23 feet of wire is used for 80 meters, with the addition of a vertical end helical coil L2 which, in fact, is a combined loading coil and radiating element added to the end of the 23-foot wire (A-B).

Using 22' 6" of the same PVC covered wire, wind 21 turns helically on a $1/2$ " diameter wood dowel or plastic tube, spacing the turns over a width of 3' 8". A tail of 18" will be left at the top end and, fitted with a strong clip, it can be attached to the main antenna wire at point B. It will be necessary to fit a suitable wood base to hold L2 vertically.

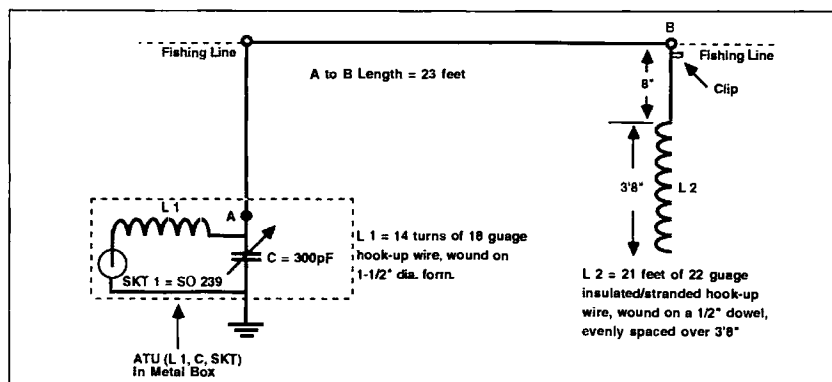


Figure 2. The indoor 80 meter antenna.

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- 2 Letters
- 3 QRX
- 4 Fun at 10,000 MHz
- 5 The 23-Foot Indoor Antenna
- 6 Accurate Low Cost VSWR Meter
- 7 An Effective 160 Meter Antenna
- 8 The "Simplest Transverter"
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The 23-Foot Indoor Antenna

Continued from page 16

At the transmitter end of the antenna wire, a simple LC ATU matches the antenna to your rig. The ATU should be built into a metal box. L1 consists of 14 close-wound turns of 18-gauge enamel copper wire, wound on a 1.2" diameter PVC form. L1 should be mounted in the metal box with at least a coil diameter of clearance away from metal work. C1 should be a good quality variable capacitor of 300 pF capacity, or even 500 pF.

The simple ATU consists of L1 + C + SKT1, in a metal box. However, an existing good LC, "T" or other ATU, could be used in place of the one shown.

Wire length A-B, plus the vertical helical section L2, form the radiating antenna. L2 should be mounted vertically and fitted with a wood base to support it—it should be at least 15" clear of walls, etc.

Ground Systems for 20 and 80 Meters

Ground connections are an ongoing problem with the indoor antenna. If there is a metal water pipe close to the TX, then a short wire stout flex can be clipped to it to form a ground. Do not connect to a plastic water pipe, gas pipes or electric wiring conduit. On 20 meters, the connecting lead should not exceed about six feet, and on 80 meters up to 15/20 feet should be satisfactory.

Figure 1b shows an artificial ground for 20 meters. It consists of 36 feet of PVC covered stranded wire (Radio Shack #278-1218) helically wound around a six-foot length of 5/8" diameter dowel of plastic pipe. The turns should be spaced to fill a length of 5'5" on the dowel. The ends of the winding can be secured with tape. The connecting lead should be four feet long. The artificial ground should not be laid on the floor, but provided with supports at least 24" high and mounted horizontally. Various positions relative to the antenna should be tried for the best results.

I developed an excellent artificial ground for 20/80 meters when living in Minneapolis in the 1970s. The operating position was near a very large metal-framed double-glazed window. A short ground lead was clipped to the metal window frame and proved to be most effective on both 20 and 80 meters. I have since tried this idea at other locations. No doubt it formed a vertical ground plane.

Conclusion

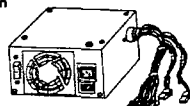
This simple 23-foot antenna gives an apartment dweller a quick and effective way of working on the 20 and 80 meter bands. Of course, the higher the antenna the better the results. I have worked DX on 20 meters using both 10 and 100 watts CW, and up to about 3,000 miles on 80 meters. However, in the interests of domestic safety and TVI elimination, a low power TX is suggested—no more than 20 watts.

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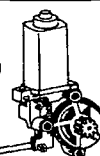
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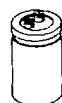
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CIRCLE 194 ON READER SERVICE CARD

Accurate Low Cost VSWR Meter

Convert this CB accessory for 1.8-450 MHz operation.

by Phil Salas AD5X

Nothing beats a good VSWR meter when it comes to playing around with new antenna designs. Unfortunately, meters that work up to 450 MHz can be quite expensive. This article describes simple modifications that can be made to popular CB-style VSWR meters to enable them to accurately perform up through the 3/4-meter ham band.

The Meter

Figure 1 shows a popular CB-type VSWR meter. Made by many different manufacturers, they use an internal directional coupler. They were very popular up until a few years ago when the transformer type VSWR meter became more popular (undoubtedly due to their lower manufacturing cost). The CB-type meter is widely available at swap fests, and can be had for very little money. I paid \$5 for mine at one of our local electronic sidewalk sales.

Upon getting home with this unit, I opened it up and was very impressed with

the quality of the coaxial coupler itself. The total internal coupler length measured five inches. For best performance, a directional coupler should be less than a quarter wavelength at the highest frequency used. A quarter wavelength at 450 MHz is about six inches, so it appeared there was some potential here. Unfortunately, the internal components had very long lead lengths and were poorly dressed. Sure enough, a precision 50 ohm load measured with this meter showed a 2:1 VSWR at 146 MHz, and a 2.8:1 VSWR at 445 MHz. Obviously, this would not do.

Modifying the CB-type Meter

Figure 2 is an internal drawing of the VSWR meter. The first thing I did was remove the detector diodes, 150 ohm terminating resistors, and bypass capacitors. I then cleaned out all excess solder. Next, I made new bypass capacitors by paralleling good rectangular ceramic 0.001 and 0.01 μF capacitors, as shown in Figure 3. The 0.01 μF capacitor is a good bypass at lower frequencies, and the 0.001 μF capacitor is a good bypass at higher frequencies. Mount these capacitors directly to the terminal strips at either end of the coupler, attempting to make the lead lengths as close to zero as possible.

Then I put in new 1/4 watt 150 ohm resistors, as shown in Figure 2. Orient these resistors so as to minimize lead length. Also, position the resistors so that the lead lengths are identical on both resistors. It doesn't matter too much if there is some lead inductance, but it's important that the lead inductance on both resistors be the same.

Next, I put in two new 1N34A detector diodes (available from Radio Shack) as shown. Again, orient the diodes for minimum lead length and ensure that the lead length on both diodes is the same.

That's all there is to it. Now for some measurements.

The Results

For my test loads, I again used my 50-ohm precision termination, a 75 ohm F-type termination with a F-to-PL-259 adapter, a home-built 100 ohm termination, and the Radio Shack RS 21-506 15 watt DC-500 MHz dummy load. The 100 ohm termination was built by sliding a 1 watt 100 ohm metal oxide resistor (RS 271-152) into a RG-6 F-

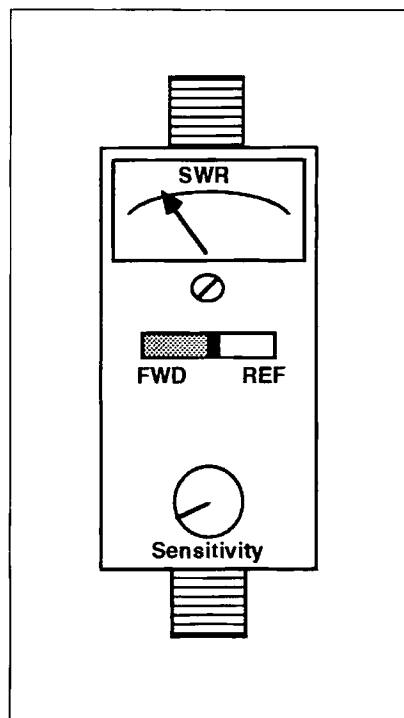


Figure 1. The once-popular CB-type VSWR meter.

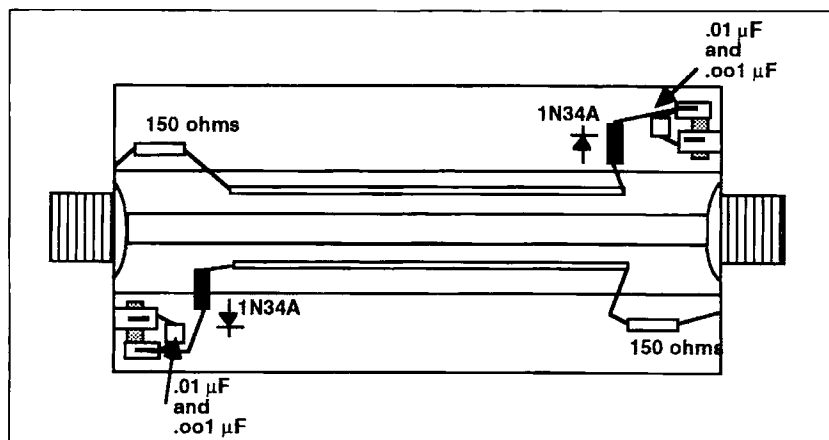


Figure 2. An internal view of the VSWR meter, showing the components to replace.

Results at 445 MHz		
	Measured VSWR	Expected VSWR
50 ohm precision load	1.05:1	1:1
50 ohm 15 watt RS load	1.10:1	1:1
75 ohm TV termination	1.50:1	1.5:1
100 ohm termination	1.80:1	2:1

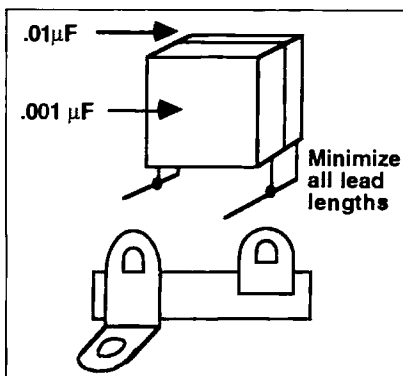


Figure 3. Making new bypass capacitors.

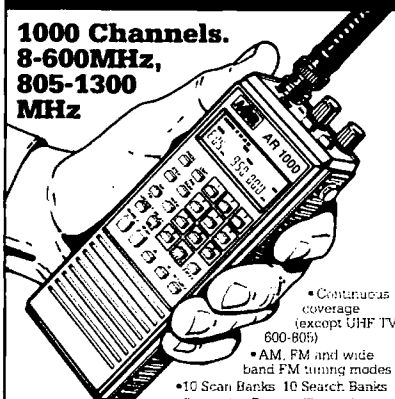
56 connector (RS 278-214). A 1 watt resistor fits perfectly into this connector, and a 1/2 watt resistor fits perfectly into the RG-59 F-59 connector (RS 278-211). The measured results at 445 MHz were as shown in the table.

Not bad! These results are certainly accurate enough for virtually anything most hams would want to do. Also, I was able to get a full-scale forward meter deflection at 450 MHz with only a quarter watt of transmit power.

I have described a means of modifying a common variety CB-style VSWR meter such that it becomes virtually a precision VSWR meter up through 450 MHz. The price is right and you'll have a piece of test equipment you'll be proud of.

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An Effective 160 Meter Antenna

How to build one on a small residential lot.

James S. Stanley KA6MMQ

Since the time of the year had arrived when low frequency propagation characteristics are improving, my attention turned to finding a way to erect an effective yet low profile antenna for 160 meter operation. Since we live on a small residential lot, approximately 100 feet by 100 feet square, my options were limited. After reviewing a few designs from several antenna reference books, it looked as though the "inverted L" Marconi antenna was going to be the only practical choice given the space available.

The Marconi L-Type

A typical Marconi L-type antenna consists of a wire which is 1/4-wavelength overall at the desired operating frequency. The length in feet is determined by the formula:

$$\frac{234}{F_{\text{MHz}}} = \text{length (feet)}$$

The usual installation of a wire inverted L antenna for 160 meter operation consists of two support poles or other structures spaced approximately 100 feet apart. Both supports need to be 30 to 40 feet overall in height. Figure 1 shows a vertical elevation sketch of the typical L-type antenna. Note that a single wire is used to form the radiator portion of the example antenna.

I chose to use steel mast tubing, sold by Radio Shack in 10-foot lengths, to act as

the end supports for the antenna system. The feedpoint had to be located near the back corner of our property so I used the inside wall of the concrete block fence which surrounds our back yard to act as the only support for the 30-foot mast. After drilling the concrete wall and installing expansion bolts, I used two 1-1/4" electrical conduit clamps to fasten the mast to the concrete. The installation is simple: The conduit clamps hold the mast tightly against the wall up to approximately seven feet above ground level. The masts have sufficient tensile strength so as to not break. They do, however, flex a bit in the wind. The other 30-foot mast is anchored to the outside wall of our house. A standard mounting kit was used for the support. Neither mast has any guy wires or ropes attached to it for stabilization—it simply was not necessary.

As you can see from Figure 1, ground radial wires are required in order to achieve satisfactory performance from the typical L antenna. In many cases like mine a few radials can be installed but the number and length are somewhat limited. The basic rule of thumb is to install as many as possible that are 1/4-wavelength long at the frequency of interest. My antenna system has two radials that are 135 feet long and several more that are shorter. You may want to bury the radials to protect them.

After erecting the wire as shown, I made

several resistance/reactance measurements at frequencies between 1.800 MHz and 2.000 MHz by using an RF impedance bridge connected to the feedpoint of the antenna. I used a General Radio model 916A RF bridge, along with a General Radio 1211-C unit oscillator as a signal source. I also used a Kenwood model R-2000 receiver as the null detector for the test setup. The results showed that the feedpoint resistance was generally quite low, approximately 10 ohms resistance at the band center, which is 1.900 MHz. This presented a very poor match for the HF transceiver used at my station. I might add that since I use one of those newfangled units with a solid-state output stage, the transceiver is designed to fold back or limit output power if the SWR is in excess of 1.5:1 in order to protect the output transistors from damage. I considered using a tuner, but since the coax cable between the operating position and the antenna feedpoint was rather long, the performance and bandwidth in this particular instance would be quite poor. Some consideration was also given to installing a remotely-controlled matching network at the antenna feedpoint and running the control wiring back to the operating position. This option seemed too complicated. What we really needed was a 50-ohm input impedance for the antenna so that standard RG-8 U coax could be used between the antenna and the operating position, where

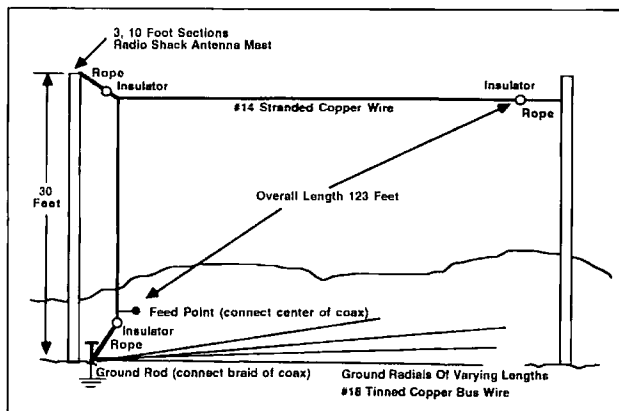


Figure 1. Single-wire Marconi "inverted L" antenna.

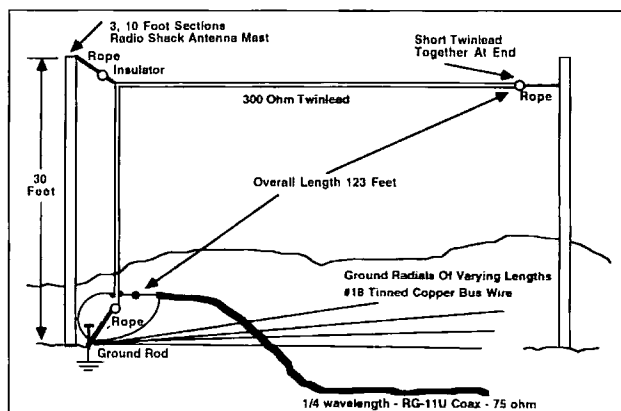


Figure 2. 300-ohm twin-lead Marconi "inverted L" antenna.

the transceiver was located.

The Twin-Lead L Antenna

After some additional investigation, I found a design for an L-type antenna to be constructed from 300-ohm TV-type twin lead. The physical dimensions were to be approximately the same except the twin lead was to be used to form a loop, similar to a folded dipole. The far end of the twin lead was to be shorted together and one end of the loop connected to ground at the feedpoint, while the other wire was to receive the power from the transceiver. Figure 2 shows a diagram of the "twin-lead L" antenna. The theory of this type of system is that the twin lead acts as an impedance transformer which increases the "radiation resistance" of the antenna, which in turn helps overcome the inherent ground system losses. The result is a more efficient antenna and a higher feedpoint impedance.

After disassembling the antenna shown in Figure 1 and replacing it with the twin-lead antenna shown in Figure 2, we repeated the resistance/reactance measurements and found that the numbers had changed significantly from the original single-wire unit. The following results were noted:

Frequency	Resistance	Reactance
1.800 MHz	110 ohms	-152 ohms
1.900 MHz	100 ohms	-3 ohms
2.000 MHz	190 ohms	+144 ohms

While these values depart from the ideal 50-ohm figure required for optimum transceiver match, they represent workable parameters which can be transformed to 50 ohms. It would be expected that the impedance measurements obtained would vary somewhat from one installation to another; however, in my case, the center of the band at 1.900 MHz measured 100 ohms resistance with a small amount of capacitive reactance. A review of transmission line theory shows us that a 1/4-wave-length section of transmission line, when presented with a load other than the nominal impedance of the line, will act as an impedance transformer under the mismatched condition. The impedance inverting property of the line provides a good match between a high-impedance circuit and a low-impedance one. I had some RG-11 U coaxial cable

on hand which has a nominal characteristic impedance of 75 ohms and decided to put that to a good use. A quarter wavelength of the RG-11 U can be calculated by the formula:

$$1/4 \text{ wavelength} = \frac{246}{F_{\text{MHz}}} \times 0.66$$

In this equation, the value 0.66 represents the velocity factor of the transmission line, which provides a correction for the line propagation characteristics when compared to propagation of the radio wave in free space. In this case, I wanted to optimize the antenna for 1.900 MHz and have minimal SWR present at the edges of the band, which are 1.800 MHz and 2.000 MHz. So what we are really talking about is trying to make the transceiver operate across 200 kHz of spectrum. The actual length of RG-11 U coaxial cable worked out to be 85.4 feet. The cable was installed as shown in Figure 2 and the resistance and reactance measurements were repeated for the three frequencies previously outlined.

This time the antenna bridge was looking at the antenna through the 75-ohm cable. The following results were noted:

Frequency	Resistance	Reactance
1.800 MHz	17 ohms	+18 ohms
1.900 MHz	56 ohms	+2 ohms
2.000 MHz	18 ohms	-9 ohms

Due to the physical layout of my ham shack in relation to the antenna and feedpoint, I needed approximately 120 feet of coaxial cable to get to the transceiver from the antenna so I decided to coil up most of the 75-ohm matching section and then install 52-ohm RG-8 U coaxial cable. Again the velocity factor was 0.66. I was a bit apprehensive about the potential attenuation from coaxial cable lengths this long; however, after consulting one of my textbooks, I determined that the worst case loss was 0.45 dB at 2.0 MHz, assuming a matched condition and a total cable length of 205 feet for the RG 11 and RG 8 types. This means that for 100 watts out of my transceiver, 90 watts would arrive at the antenna. After the installation of the coaxial cable to the operating position was complete, I again connected the antenna bridge and noted the following measurements:

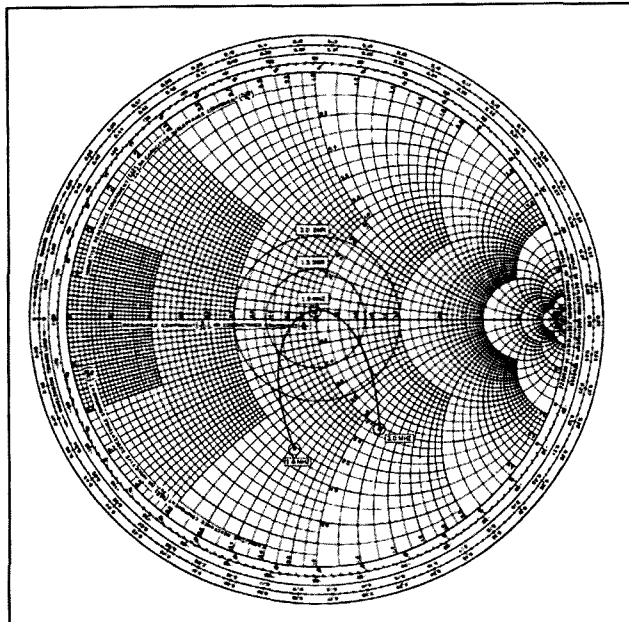


Figure 3. Smith chart showing SWR versus frequency measurements taken at the operating position.

```

0 REM MISMATCHED TRANSMISSION LINE VER. 2.00
1 CLS : SCREEN , 0: COLOR 15, 1
2 CLS : KEY OFF:
3 PRINT : PRINT " AN RF DESIGN AID DEVELOPED FOR AMATEUR USE BY K4MMQ"
4 PRINT : INPUT " TRANSMISSION LINE or MATCHING SECTION IMPEDANCE " ; Z
5 PRINT : INPUT " ANTENNA RESISTANCE " ; LR
6 PRINT : INPUT " ANTENNA REACTANCE " ; LX
7 PRINT : INPUT " SWR REFERENCE IMPEDANCE (Typical 50 Ohms) " ; N
8 PRINT : INPUT " OPERATING FREQUENCY IN MHz " ; F
9 PRINT : INPUT " TRANSMISSION LINE DELAY IF MATCHED ( Degrees ) " ; P
10 PRINT : INPUT " TRANSMISSION LINE DELAY IF NOT MATCHED ( Degrees ) " ; P
11 IF F <= 1.799 OR F >= 29.999 THEN BEEP: GOTO 12 ELSE 14
12 CLS : PRINT : PRINT " OPERATING FREQUENCY IS OUT OF RANGE!"
13 PRINT : PRINT " SELECT OPERATING FREQUENCY 1.80 TO 30.0 MHz: GOTO 8
14 IF P > 0 THEN P = P * -1
15 R = .0174533
16 XA = LX - (Z * TAN(P * R))
17 YB = (TAN(P * R)) / Z: XB = -LR * S: SR = 1 + (LX * S)
18 ZA = SOR((LR * 2) + (XA * 2))
19 ZB = SOR((XB * 2) + (YB * 2))
20 PA = (ATN(XA / LR)) / R
21 PB = (ATN(XB / SR)) / R
22 ZC = ZA / ZB: PC = PA - PB
23 IR = ZC * (COS(PC * R)): IX = ZC * (SIN(PC * R))
24 A = (Z / (TAN(P * R))) + LX
25 LP = (ATN(LR / A)) / R
26 IF LP > 0 THEN LP = LP - 180
27 IF IR < 0 THEN IX = IX * -1
28 IF IR < 0 THEN IR = IR * -1
29 NP = (ATN(IX / IR)) / R: NP = LP - NP
30 IF P <= -180 THEN NP = NP - 180
31 IF P <= -360 THEN NP = NP - 180
32 IF P <= -540 THEN NP = NP - 180
33 W = (985.6) * V / 360
34 Q = W * P: IF Q <= 0 THEN Q = Q * -1
35 IF N <= 0 THEN N = N * 1
36 YI = (IR * N) * 2
37 IU = (IR * N) * 2
38 IO = (IX) * 2
39 E = SOR(IY * 10)
40 C = SOR(IU * 10)
41 O = E + C
42 G = E - C
43 W = O / G
44 CLS :
45 PRINT : PRINT " MATCHED TRANSMISSION LINE DELAY = " ; P: "Degrees"
46 PRINT : PRINT " MISMATCHED TRANSMISSION LINE DELAY = " ; NP: "Degrees"
47 PRINT : PRINT " TRANSMISSION LINE INPUT RESISTANCE = " ; IR: "Ohms"
48 PRINT : PRINT " TRANSMISSION LINE INPUT REACTANCE = " ; IX: "Ohms"
49 PRINT : PRINT " TRANSMISSION LINE LENGTH = " ; O: "Feet"
50 PRINT : PRINT " SWR AT TRANSMISSION LINE INPUT = " ; N: "1"
51 PRINT :
52 PRINT : INPUT " CHANGE MATCHING SECTION LENGTH ( Y OR N ): " ; AS
53 IF AS = "Y" OR AS = "N" THEN 54 ELSE 55
54 CLS : GOTO 10
55 PRINT : INPUT " ENTER NEW DATA & RETURN ( Y OR N ): " ; BS
56 IF BS = "Y" OR BS = "N" THEN 57 ELSE GOTO 58
57 CLS : GOTO 4
58 SYSTEM

```

Figure 4. BASIC program: Mismatched Transmission Line.

Frequency	Resistance	Reactance
1.800 MHz	24 ohms	-36 ohms
1.900 MHz	49 ohms	+3 ohms
2.000 MHz	48 ohms	-59 ohms

These final resistance/reactance measurements taken at the

operating position are values which can be easily transformed to 50 ohms by using a simple matching network such as an L-type configuration. For the sake of visual interpretation of the final measurements, I

Parts List, Antenna

Quantity	Description	Source	Part #
6	10' mast sections	Radio Shack	15-843
1	Wall-mount kit	Radio Shack	15-883
3	50' lengths 300-ohm twinlead (to be spliced together)	Radio Shack	15-1153
1	Ground rod	Radio Shack	15-530
2	Egg insulator paks	Radio Shack	278-1335
500'	#18 solid tinned copper wire for ground radials	Pacer Electronics	
85'	RG11/U 75-ohm coax	Pacer Electronics	
120'	Belden 8237-type RG 8/U coax	Pacer Electronics	
2	1-1/4" conduit clamps	Ace Hardware	
20'	5/16" nylon rope	Ace Hardware	

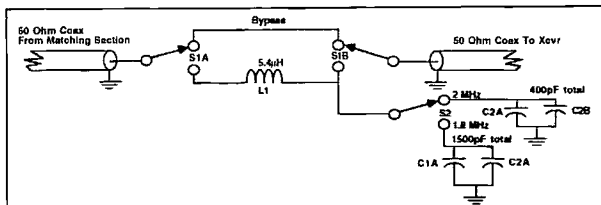


Figure 5. Simple L network antenna matching unit.

Parts List, ATU

Symbol	Rating or Value	Source	Part #
S1	6A @ 250 VAC	Radio Shack	275-652
S2	6A @ 250 VAC	Radio Shack	275-652
L1	5.4 uH	Barker & Williamson	3052
(16 turns #14 solid copper wire on a 1.5" form, six turns per inch)			
Symbol	Rating or Value	Source	
C1A	ARCO DM19 500-volt 680 pF	Circuit Specialists	
C1B	ARCO DM19 500-volt 820 pF	Circuit Specialists	
C2A	ARCO DM15 500-volt 200 pF	Circuit Specialists	
C2B	ARCO DM15 500-volt 200 pF	Circuit Specialists	

Barker & Williamson, 10 Canal Street, Bristol PA 19007.
Circuit Specialists, P.O. Box 3047, Scottsdale AZ 85271.
Pacer Electronics, 1630 W. 12th Place, Tempe AZ 85281.

normalized the figures shown above for 50 ohms and plotted them on a Smith chart (see Figure 3) with a 1.5:1 and 2.0:1 SWR circle also drawn on the graph. As you can see in this chart, a substantial portion of the band falls within the 2.0 region, and approximately 40 kHz either side of the band center at 1.900 MHz falls within the 1.5:1 region. This means that from 1860 kHz to 1940 kHz my solid-state transceiver will produce full output power without any additional antenna tuner or ATU.

Program to Predict Impedance

The Marconi L antenna characteristics can vary greatly from one installation to another. It should be understood that, depending upon the resistance and reactance of the antenna feedpoint, it may or may not be necessary to use exactly 1/4-wavelength or -90 degrees of transmission line in order to obtain a satisfactory match. The matching section could be longer or shorter for optimum results.

Since a certain portion of this project could result in tedious trial-and-error cutting of coaxial lines, given the variables involved from one installation to another, I decided prior to beginning the work to write a simple computer program in BASIC to predict the resulting impedance at one end of the transmission line when the other end is terminated with an impedance other than the nominal characteristic impedance of the line.

See Figure 4 for the program listing. If you care to enter the program codes for yourself, it should only require a few minutes of time. Also, I have uploaded the program to the 73 BBS so that it can be downloaded for your use. The program is titled "Mismatched Transmission Line" and will operate on any IBM compatible computer. I should point out that the program and the matching/impedance transformation technology is applicable at any of the amateur HF frequencies you might be interested in.

Matching Network Circuit

Now for a very simple yet effective matching network which will enable you to operate across the entire band from 1.800 to 2.000 MHz without making adjustments. That's right, no knobs to turn or tweak!

The circuit shown in Figure 5 has a basic ATU consisting of a single series inductor with two fixed shunt capacitors, either of which can be selected by switch S2. When operating in the bypass mode the unit is out of the circuit and, as I mentioned earlier, the transceiver will put out full power from 1860 kHz to 1940 kHz. If operation below 1860 kHz is desired, the ATU is switched in circuit and switch S2 is placed in the 1.8 MHz position. If operation above 1940 kHz is desired, switch S2 is placed in the 2.0 MHz position. It is important to understand that the design criteria for this circuit was only to keep the SWR at substantially less than 1.5:1 at all portions of the band, not to effect an absolute 1:1 match at any frequency.

If you examine one of the many graphs published in the various antenna textbooks, it is evident that the loss in transmitted power at an SWR of 1.5:1 is only 4%. That amount of loss is insignificant and will produce no perceptible change in the received signal from your station. If you must have a 1:1 SWR at whatever frequency you happen to be operating on, I suggest you use a standard ATU or transmatch, such as the SPC design. These are described in various antenna textbooks and are also for sale commercially from several equipment manufacturers. In that case, you may omit this ATU from the circuit. The ATU is designed to handle 100 watts CW or RTTY continuously, without heating or other problems. However, if you plan to operate with power levels in excess of 100 watts, you may wish to construct the matching network with components that have a higher voltage and/or current rating.

Construction Techniques

As far as construction techniques go, I constructed my ATU on a small metal plate and mounted it on the wall of my shack so that it was out of the way. If you want to get fancy, you could put the circuit in a metal box with coax connectors.

There you have it, operation across the entire 160 meter band, with no remote motor controlled antenna matching units or other complicated devices. In fact, most of the matching is accomplished by the selection of coaxial cable lengths and types. The coaxial cable is a necessity in order to connect the antenna feedpoint to the transceiver, so why not let it solve the impedance matching problems also? The RF impedance bridge and oscillator I used to make the resistance and reactance measurements were purchased surplus for a modest price. There are also several new solid-state units on the market which have the generator and detector self-contained; one even has a frequency counter built into it.

One last note: I have enjoyed many contacts on 160 meters since installing this antenna and matching system. At night, I am consistently able to work other stations all over the country and receive good signal reports, with only 100 watts out of the transceiver.

References:

- Antennas*, 2nd edition, by John D. Kraus W8JK.
- Radio Handbook*, 23rd edition, by William I. Orr W6SAI.
- Radio Data Reference Book*, 5th edition, G.R. Jessop G6JP.
- Antenna Engineering Handbook*, 2nd edition, Johnson and Jasik.

The "Simplest Transverter"

Check out the 6 meter band with this inexpensive 2 meter interface.

by Bob Witmer W3RW

Interested in trying a new band at minimum expense? Here's a receiving and transmitting converter (transverter) that requires no operating power (other than local oscillator DC) or T/R switching for operation, and will provide a minimum communications capability for checking out a new band such as 6 meters using a 2 meter transceiver.

While checking out the latest Mini-Circuits Labs catalog I was impressed by a new family of low-cost, high-level double-balanced mixers (DBMs): TUF-1H, TUF-2H and TUF-3H. With this in mind I decided to see how simple a transverter could be made. To simplify the design, I selected operation using the 6 and 2 meter bands and a 90 MHz LO. The high level DBM provides a useful output power level even though it is still on the low side (but not as low as the output of a standard level DBM, which is approximately 20 times lower). In addition, the transverter will work with FM, SSB and CW modes.

What is it? Well it really is nothing more than a high-level double-balanced mixer (DBM) with an attenuator on the transceiver side, an output low-pass filter on the antenna side, and a local oscillator (see Figure 1).

As mentioned before, this approach is practical because the high-level DBM's linear power capability goes all the way to 25 milliwatts. Without the need for any additional power (other than the local oscillator) you can get an output that is approximately 5 milliwatts—the actual power depends on a variety of factors. Measured transverter output using a HP 431D power meter was 5.1 milliwatts at 52.29 MHz. The other mixer characteristic that makes the simplest transverter possible is the DBM's bidirectional capability: The RF and IF ports can be interchanged, allowing mixer operation to

occur in either direction.

Five milliwatts—you've got to be kidding! Now, before you laugh too much about that power level, consider that one well-known popular 2 meter hand-held transceiver has a 100 milliwatt low power position (one new 2 meter transceiver even has a 20 milliwatt position!) and that when used with the normally supplied inefficient "rubberduck" antenna, which typically has anywhere from a 6 to 10 dB loss factor relative to a dipole, the resulting radiated power could be on the order of 10 to 25 milliwatts—only several dB higher than 5 milliwatts. In addition, since the free-space line-of-sight path loss at 53 MHz is approximately 9 dB less than the loss at 146 MHz, if that 5 milliwatts is connected to a dipole or better equivalent antenna, communications similar to low power 2 meter hand-held operation is possible. This power level should make the FCC happy!

Receive Performance

If the transverter is used with a 2 meter transceiver with a 500 mW low power output, a 13 dB attenuator is needed on the input to limit the power to the linear operating range of the DBM. In this case, the total loss during receive is the conversion loss of the DBM—7 dB, plus the 13 dB loss of the attenuator pad for a total loss of 20 dB—equivalent to reducing the signal to 1/10 of its value. If your 2 meter receiver sensitivity is 0.2 μ V then a 20 dB loss in front of the receiver will be equivalent to using a 2.0 μ V receiver—which is not really all that bad considering the stations you can work using a 5-milliwatt!

In actual practice I've had QSOs on simplex and through several local 6 meter repeaters using only 2 milliwatts—approx-

mately half as much power! In all honesty, my signal was noisy, but it was fully intelligible.

My antenna is a Cushcraft Ringo at 25 feet, fed through about 30 feet of RG-8/U. Considering the simplicity of the transverter, the performance was surprising! If you operate CW or SSB, greater performance will be obtained. Figure 2 shows the transverter losses during transmit and receive.

How It Works

Receive: During receive, 6 meter antenna signals are connected via the low-pass filter to the DBM, where they are mixed with the 90 MHz local oscillator injection. The transverter acts as a typical receive converter. The local oscillator's output passes through the input attenuator to the 2 meter rig.

Transmit: The 2 meter rig's low power transmit signal is fed through the attenuator, where it is reduced to a level acceptable to the DBM and passed to the DBM. The 2 meter signal is mixed in the DBM with the 90 MHz LO creating outputs in the 6 meter band and in the 230 MHz region. The output of the DBM is connected to the low-pass filter, which passes the 6 meter signal and attenuates the 230 MHz output and any 2 meter and local oscillator signal feed-through.

Detailed Operation Description

The following sections provide a detailed description of the transverter's operation and refer to Figure 3, the schematic diagram.

Input Attenuator: The input attenuator of the transverter was designed for a 1/2 watt 2 meter power level, using approximate resistor values from the ARRL Handbook's 50 ohm resistive attenuator table, to provide ap-

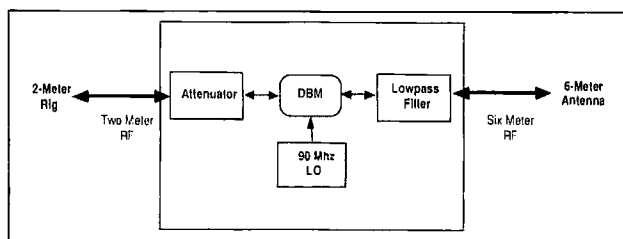


Figure 1. Simplest Transverter diagram.

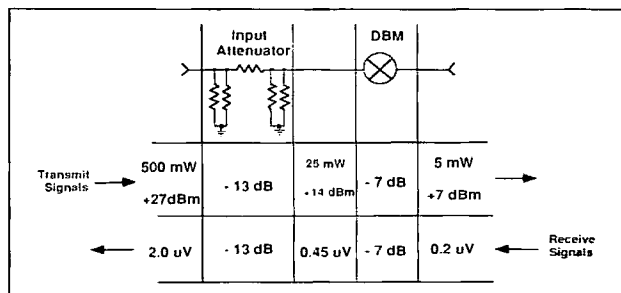


Figure 2. Transverter section loss diagram.

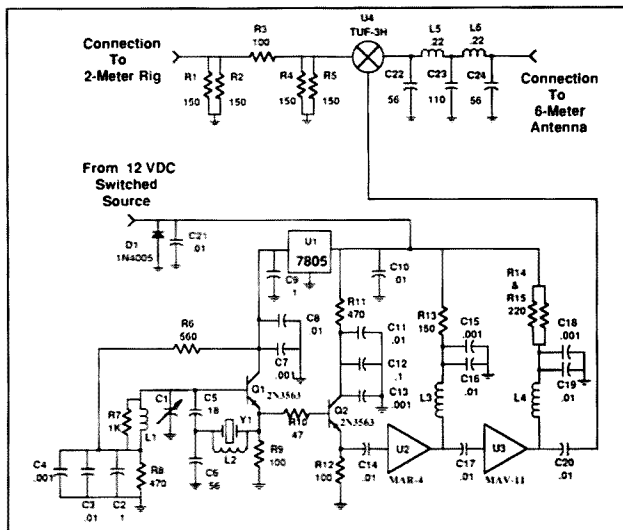


Figure 3. Simplest Transverter schematic.

proximately 13 dB of attenuation. This reduces the 1/2 watt to the recommended maximum linear rated input of the DBM, 25 mW. The input and output sections of the attenuator are made up of two paralleled 150 ohm 1/2 watt resistors.

Mixer: As mentioned before, the transverter takes advantage of the DBM's bidirectional performance characteristic. The DBM's ports are matched to the appropriate frequency range sections of the transverter. The IF or lowest frequency port (Pin 2) is used as the 6 meter port. The LO output is connected to the "LO" port (Pin 4) and the 2 meter side is connected to the "RF" port (Pin 1). Pin 3 of the DBM is connected to case ground and does not need a separate connection if the case is grounded.

Local Oscillator: The 90 MHz local oscillator circuit is adapted from the July 1989 *QST* article, "A Clean, Low-Cost Microwave Local Oscillator," by Richard Campbell. Mini-Circuits Labs MAR-4 and MAV-11 MIMICs are used to provide the +14 to +17 dBm injection needed for high-level DBM operation. The circuit will "free" oscillate with a 47k resistor in place of the crystal and L2. This can be used to get the oscillator L1 and C1 components on

frequency to insure crystal oscillation. L1 is non-critical. One approach is to experiment until you get a coil that gives you the desired frequency oscillation range when tuned with C1. When the free-run frequency tuning range covers the crystal frequency, remove the 47k resistor and install L2 and the crystal, then adjust C1 for reliable starting and fine frequency trimming.

Local Oscillator Frequency Selection

FM & Repeater Band Segment Operation:

A 90 MHz 5th overtone crystal. Y1, was chosen for the oscillator so that the receive range for 53 to 54 MHz would convert to 143-144 MHz to simplify frequency readout. Many of today's 2 meter rigs will operate, or can be modified for full operation, down to 142 MHz, permitting this approach. If your rig will

not make this range, I would recommend using a 93 MHz crystal. This will convert the active 6 meter repeater output section of the band (usually the lower half of the 53.01 to 53.97 MHz range) to the repeater input/simplex section of the 146 to 147 MHz band.

CW & SSB Band Segment Operation: Operating the Simplest Transverter with a 94 MHz oscillator will translate 144 MHz to 50 MHz for weak signal work but would convert the 6 meter repeater outputs to the low end of the 147 to 148 MHz range—the repeater output

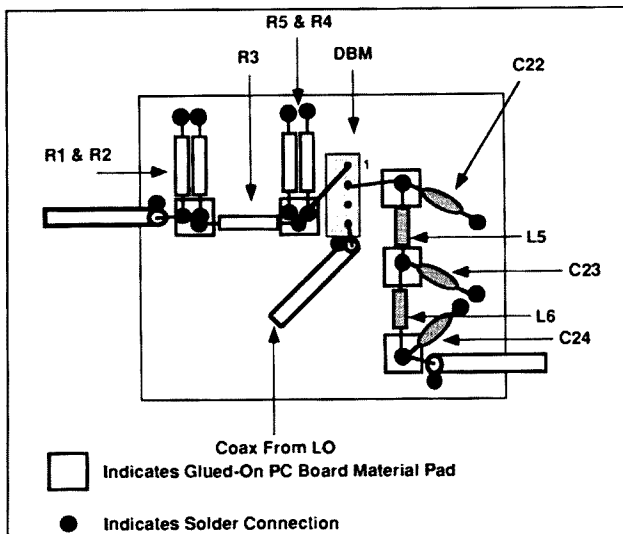


Figure 4. Approximate layout of mixer/filter board (not to scale).

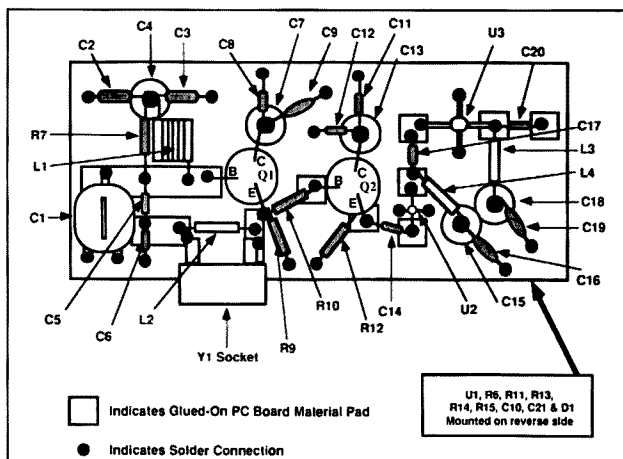


Figure 5. Approximate layout of the local oscillator board (not to scale).

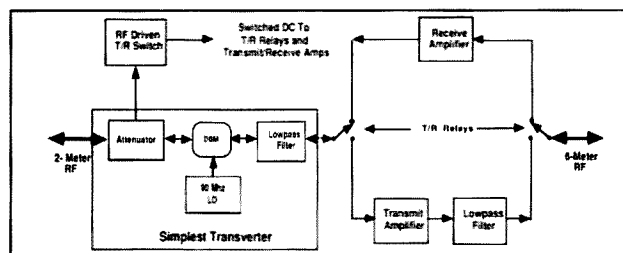


Figure 6. Upgraded Simplest Transverter diagram.

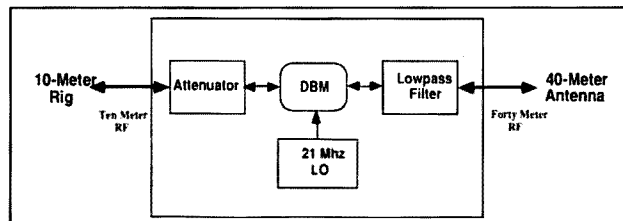


Figure 7. Simplest Transverter diagram for 10/40 meter operation.

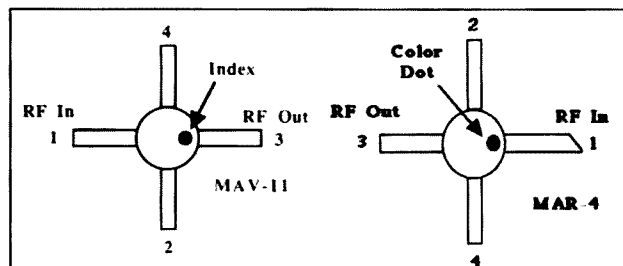


Figure 8. Pin identification of the MAV-11 and MAR-4 MMICs.

section of the 2 meter band. Local 2 meter repeater signals are often strong enough that some bleed-through is noted during base operation with an outside antenna if you use this frequency plan.

Output Filter: Because of the translator's frequency plan and the low output power level, filtering requirements are not severe. The 6 meter side of the DBM is connected to a five-element low-pass filter (L5, L6 C22, C23 and C24) whose values were selected from the five-element low-pass filter table in the *ARRL Handbook*, targeted at a 3 dB corner at 60 MHz with 20 dB attenuation at 83 MHz and 40 dB at 125 MHz.

Construction, Check-Out and Operation

The Simplest Transverter was constructed in two parts to simplify assembly and check-out—the input attenuator/DBM/output low-pass filter and the local oscillator. Both were assembled by gluing small pieces of single-sided board material, cut to the size required for the connection pads, onto a double-sided G-10 circuit board where desired. If a change is required, you can pry the desired pad loose and glue it in the new location. Grounding is accomplished by soldering directly to the ground plane—keeping the RF circuit ground leads as short as possible. Feed-through bypass capacitors are used for bypass requirements and DC power distribution is done on the opposite side of the board. Figures 4 and 5 show approximate layouts.

As mentioned before, local oscillator operation can be checked with a broadcast FM radio. With the LO operating, the transverter can be used as a receive converter for initial check of operation. An FM broadcast receiver (tuned to the second harmonic) can also be used to monitor the output of the transverter during transmit.

When operating with the transverter, use your 2 meter rig just as you normally would (in low power position). Program CTCSS and repeater split parameters as required if repeater operation is intended.

Higher performance can be achieved by adding receiver and transmit amplification stages to the transverter. Figure 6 shows one way that this could be accomplished.

Other Bands

The Simplest Transverter approach can be applied to other frequency band combinations. One example of this is shown in Figure 7, where the Simplest Transverter approach is used to provide 40 meter capability using a 10 meter transceiver. Of course, the input attenuator value and the low-pass filter characteristics must be adjusted, as required, for different power levels and operating frequencies.

Only slightly more complex than a receive converter, the Simplest Transverter provides about the simplest way to obtain operation on 6 meters with a 2 meter rig—any mode. This same approach can be used to obtain similar results on other ham bands.

Many thanks to all those who've had their ears abused by my noisy signals during QSOs while checking out the ability to conduct practical communications with milliwatt level transmit power.

Part

Part	Description
C1	2-10 pF ceramic trimmer or equivalent
C2,C9,C12	0.1 μ F disc ceramic capacitor, 16-20 volts
C3,C8,C10,C11,C14,C16,C17, C19,C20,C21	0.01 μ F disc ceramic capacitor, 16-20 volts
C5	18pF NPO ceramic capacitor, 16-20 volts
C6	56 pF NPO ceramic capacitor, 16-20 volts
C4,C7,C13,C15,C18	0.001 μ F feedthrough
C22,C24	56 pF miniature silver-dipped mica
C23	100 pF miniature silver-dipped mica
D1	1N4005 silicon diode
L1	5 turns no. 28 enameled wire, 0.1" i.d., 0.2" long
L2	0.33 μ H miniature RF choke
L3,L4	0.33 to 1.6 μ H miniature RF choke
L5,L6	0.22 μ H air-wound or toroid coil—or miniature choke
R6	560 ohm 1/4 watt carbon film resistor
R7	1,000 ohm 1/4 watt carbon film resistor
R8,R11	470 ohm 1/4 watt carbon film resistor
R9,R12	100 ohm 1/4 watt carbon film resistor
R10	47 ohm 1/4 watt carbon film resistor
R3	100 ohm 1/2 watt carbon film resistor
R1,R2,R4,R5,R13	150 ohm 1/2 watt carbon film resistor
R14,R15	220 ohm 1/2 watt carbon film resistor
Q1,Q2	2N3563, 2N5179—NPN transistor or equivalent
U1	7805 or equivalent 5 volt regulator
U2	Mini-Circuits Lab MAR-4 MIMIC amplifier
U3	Mini-Circuits Lab MAV-11 MIMIC amplifier
U4	Mini-Circuits Lab TUF-2H double-balanced mixer (also 3H & 1H)
Y1	90 MHz 5th overtone, series resonant-crystal

The Mini-Circuits Labs components can be obtained from M. Lader Co., 1495 Alan Wood Road, Conshohocken PA 19428; (215) 825-3177, (800) 442-3177.

The 5th overtone 90 MHz crystal is available from Marden Electronics Co., Inc., 32100 Droster Ave., P.O. Box 277, Burlington WI 53105; (800) 222-6093. The price is \$14, including postage and handling.

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CIRCLE 259 ON READER SERVICE CARD

Where's the Fun?

The 10 meter test had started, and I expected the band to open about the time I arrived at the motel. Rig and gel cell were in the trunk, Maxi-J was right beside. rolled up inside the launcher pail. Room with a view. Maxi takes off from the balcony sloping down to a tree. His tail slips under the door. And I'm 59 in Japan.

J-10	J-15	J-17	J-20	J-30	J-40	Info
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CIRCLE 151 ON READER SERVICE CARD

Transverter Parts List

Description

Part	Description
C1	2-10 pF ceramic trimmer or equivalent
C2,C9,C12	0.1 μ F disc ceramic capacitor, 16-20 volts
C3,C8,C10,C11,C14,C16,C17, C19,C20,C21	0.01 μ F disc ceramic capacitor, 16-20 volts
C5	18pF NPO ceramic capacitor, 16-20 volts
C6	56 pF NPO ceramic capacitor, 16-20 volts
C4,C7,C13,C15,C18	0.001 μ F feedthrough
C22,C24	56 pF miniature silver-dipped mica
C23	100 pF miniature silver-dipped mica
D1	1N4005 silicon diode
L1	5 turns no. 28 enameled wire, 0.1" i.d., 0.2" long
L2	0.33 μ H miniature RF choke
L3,L4	0.33 to 1.6 μ H miniature RF choke
L5,L6	0.22 μ H air-wound or toroid coil—or miniature choke
R6	560 ohm 1/4 watt carbon film resistor
R7	1,000 ohm 1/4 watt carbon film resistor
R8,R11	470 ohm 1/4 watt carbon film resistor
R9,R12	100 ohm 1/4 watt carbon film resistor
R10	47 ohm 1/4 watt carbon film resistor
R3	100 ohm 1/2 watt carbon film resistor
R1,R2,R4,R5,R13	150 ohm 1/2 watt carbon film resistor
R14,R15	220 ohm 1/2 watt carbon film resistor
Q1,Q2	2N3563, 2N5179—NPN transistor or equivalent
U1	7805 or equivalent 5 volt regulator
U2	Mini-Circuits Lab MAR-4 MIMIC amplifier
U3	Mini-Circuits Lab MAV-11 MIMIC amplifier
U4	Mini-Circuits Lab TUF-2H double-balanced mixer (also 3H & 1H)
Y1	90 MHz 5th overtone, series resonant-crystal

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The 5th overtone 90 MHz crystal is available from Marden Electronics Co., Inc., 32100 Droster Ave., P.O. Box 277, Burlington WI 53105; (800) 222-6093. The price is \$14, including postage and handling.

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Stretch Beam?

It was Sunday morning of Field Day. The sky to the east showed color as 40 meters turned scratchy. I switched to 20 CW. There was an SM calling CQ. Why not see if he could hear my 4 watts? He did. I called CQ and worked DL and JA. No one else was working DX. Funny what happens when you have a StretchBeam.

S-10	S-15	S-17	S-20	S-30	S-40	Info
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CIRCLE 233 ON READER SERVICE CARD

Build the Tone Processor

*Eliminate interfering signals with this versatile
switched capacitor audio filter.*

by Kazuo Niwa JA1AYO

The tone processor described here uses the National Semiconductor MF4, a four-stage Butterworth low-pass filter. As Figure 1 shows, unlike conventional audio filters, the capacitor filter cutoff f_c can be changed by varying the clock frequency f_{clk} . There are two varieties of MF4 switched capacitor filters, the MF4-100 and the MF4-50. The MF4-100 is shown in Figure 1. For the MF4-50, the relationship between the cutoff frequency

and the clock frequency is $f_c = f_{clk}/50$. Referring to Figure 1, the input impedance Z_{in} is 3 megohm for a f_c of 3 kHz and 20 megohm for a f_c of 500 Hz. The SCF has an ideal filter gain of around about 1. Attenuation for a four-stage filter is 24 dB per octave.

The MF4-100, an 8-pin DIP package is used in this tone processor. The cutoff frequency f_c varies from 500—3000 Hz and f_{clk} varies over a range 100 times

greater between 50—300 kHz. Two MF4s are used in series to create an eight-stage low-pass filter in order to achieve greater attenuation.

Once power supply connections are made, a frequency counter can be connected to terminal TP as shown in Figure 2 to measure the clock frequency f_{clk} without affecting the oscillator frequency. As variable resistor VR is adjusted, the cutoff frequency f_c and clock frequency

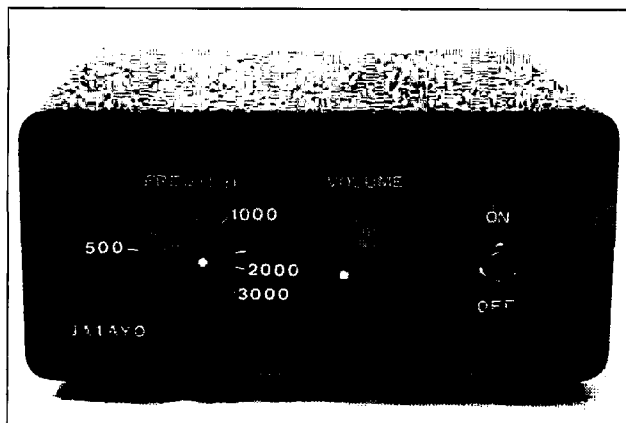


Photo A. Remove interference with this versatile switched capacitance audio filter.

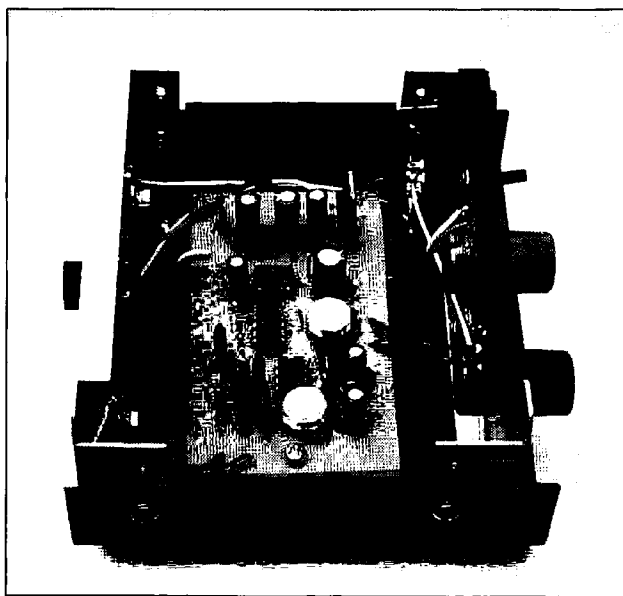


Photo B. Inside view of the tone processor.

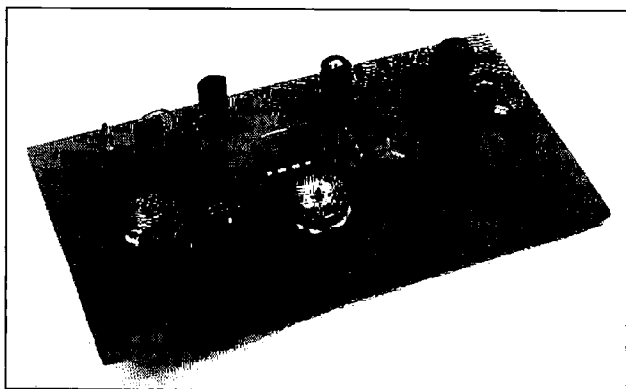


Photo C. The completed PC board.

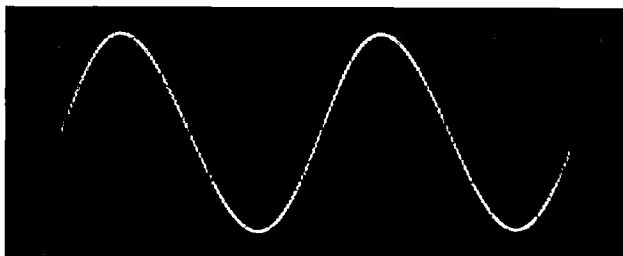


Photo D. Chopping of the waveform by the clock signals can be observed.

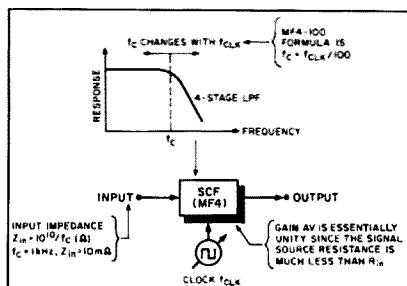


Figure 1. A switched capacitor filter (SCF) can be made using the MF4-100.

f_{clk} for an 24 dB/octave four-stage low-pass filter and a 48 dB per octave low-pass filter vary as shown in Figure 2b. This tone processor is very effective in removing unwanted noise from SSB signals.

Circuit Description

The final version of the tone processor, shown in Figure 3 and Figure 4, is designed chiefly for improving SSB reception, so low-pass filters (using the SCF ICs) as well as high-pass filters are used to provide audio balance. An LM358 op amp Chebyshev active filter with f_c fixed at 300 Hz has three stages and 18 dB/octave attenuation. An audio amplifier follows the high-pass and low-pass filters to drive a speaker.

The circuit shown in Figure 4 should be connected to a 12-volt power supply. An 8-volt three-terminal voltage regulator is used to ensure that the voltage supplied

to the MF4s holds steady to ensure clock frequency f_{clk} stability. ICI, a LM358, shown in Figure 5, is composed to two op amps: One is a three-stage Chebyshev high-pass filter; the other provides a $1/2 V_{cc}$ output which is used by the MF4s.

The high-pass filter uses fixed RC passive type components to set the clock frequency, but the two MF4s of the eight-stage low-pass filter use variable resistors to change the low-pass filter clock frequency.

The National Semiconductor ICs are available through Digi-Key Corporation (800-344-4539) and other sources. The

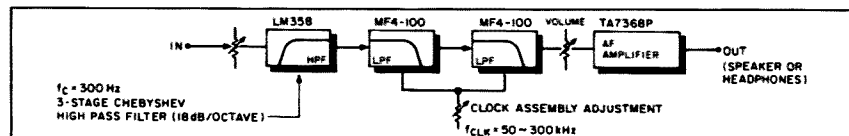


Figure 3. Block diagram for the complete tone processor using two MF4-100 SCFs.

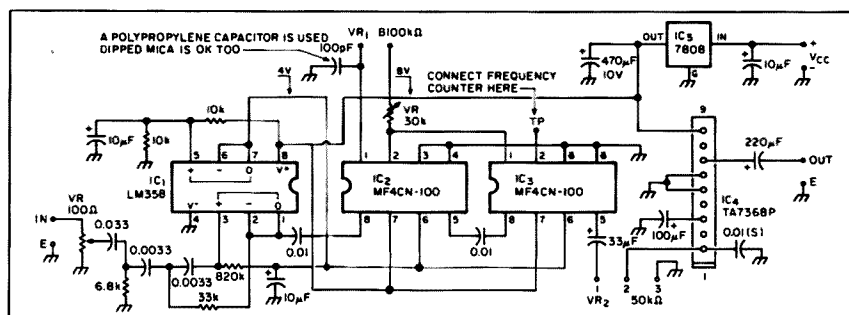


Figure 4. Circuit diagram for the SCF tone processor circuit.

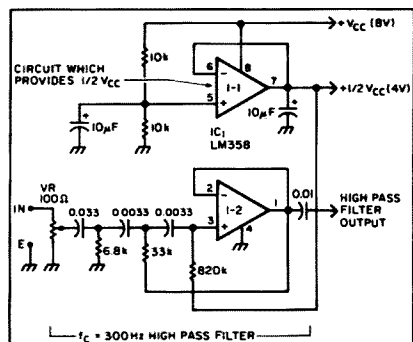


Figure 5. 3-stage Chebyshev high-pass filter and $1/2 V_{CC}$ circuit.

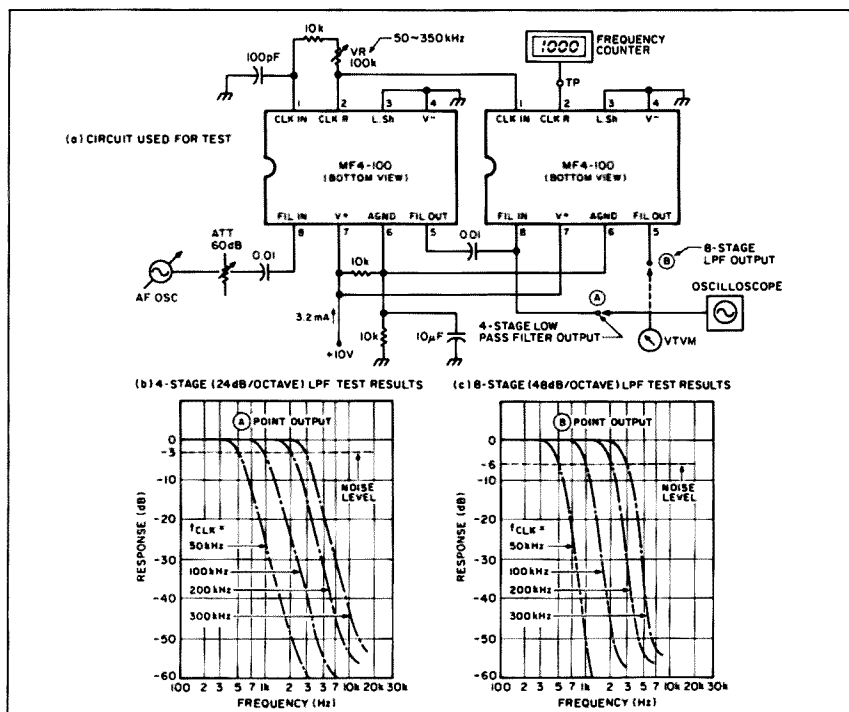


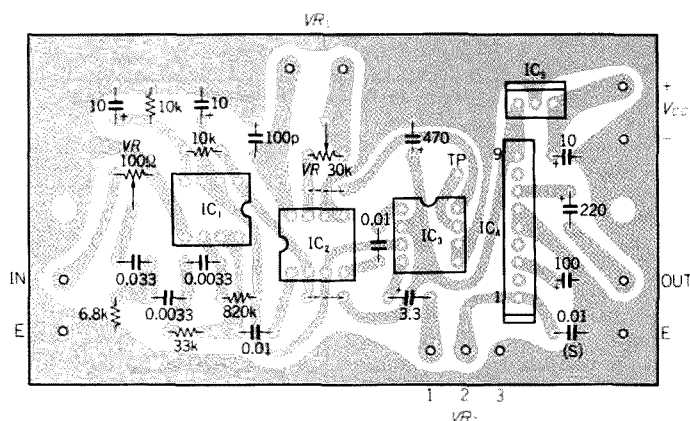
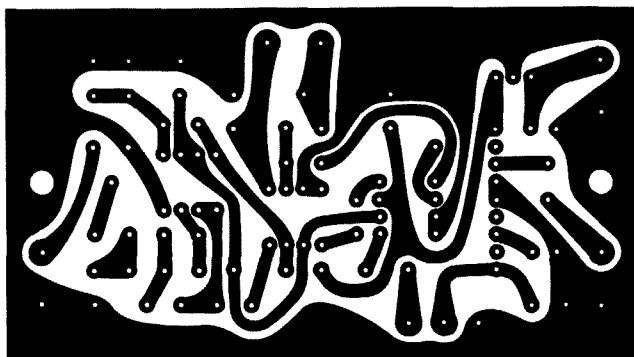
Figure 2 (a). Prototype 4-stage and 8-stage Butterworth low-pass filters. (b). Frequency response for the 4-stage filter. (c). Frequency response for the 8-stage filter.

Toshiba TA7368 audio amplifier IC is available from MCM Electronics, 858 E. Congress Park Dr., Centerville, OH 45459-4072; Telephone: (800) 543-4330 or (513) 434-0031.

Printed circuit patterns for the circuit boards and the circuit layout are shown in Figure 6. Place a pin in the circuit board hole marked test point (TP). Photo A shows the completed tone processor in its case. The frequency characteristics of the tone processor where the cutoff frequency f_c is set to 2 kHz are shown in Figure 7. The upper and lower slopes of the curve illustrate the difference in the characteristics of the low-pass Butterworth filter and the high-pass Chebyshev filter. The circuit board can be put in a project box, as shown in Photos A and B, with two rotary variable resistors on the front panel to control the cutoff frequency of the low-pass filter and the volume, as well as an on/off switch.

Operation

Put the tone processor between a transceiver and external speaker. If the tone processor is OFF, then the speaker line simply runs through the tone processor unaffected. Use insulated wire on the



PARTS LIST

IC1	LM358 op amp
IC2, IC3	MF4CN-100 SCF IC
IC4	TA7368 audio amplifier (see Note 2 for source)
IC5	7808 8-volt voltage regulator
1	100 pF capacitor (polypropylene or dipped mica)
1	0.0033 μ F mylar capacitor
1	0.01 μ F mylar capacitor
1	0.033 μ F mylar capacitor
1	0.01 μ F ceramic capacitor
1	3.3 μ F electrolytic
3	10 μ F electrolytic
1	100 μ F electrolytic
1	220 μ F electrolytic
1	470 μ F electrolytic
1	6.8k resistor
2	10k resistor
1	33k resistor
1	820k resistor
1	100k potentiometer
1	30k potentiometer

Note 1: An etched and drilled PC board is available for \$4.50 + \$1.50 postage from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Note 2: The Toshiba TA7368 audio amplifier IC is available from MCM Electronics, 858 E. Congress Park Dr., Centerville OH 45459-4072. Telephone: (800) 543-4330 or (513) 434-0031.

Note 3: All other parts should be available from Digi-Key Corporation at (800) 344-4539 or Mouser Electronics at (800) 346-6873.

run from VR1 to avoid frequency changes—putting your finger near that wire is enough to shift the clock frequency. The frequency markings on the cutoff frequency control as crowded in the upper range are shown in Photo A. This problem could be solved by a D curve variable resistor, but they are hard to get.

While listening to 40 meter SSB with the tone processor, much unwanted noise could be eliminated by adjusting VR1. For SSB a cutoff frequency of about 1000 Hz proved to be the best for reducing noise; below that frequency, intelligibility suffers. The tone processor generally improves readability 4 signals to readability.

Reprinted from CQ Ham Radio, November 1991, pp. 404-408. Translated by David Cowhig WAILBP.

Figure 6 (a). PC board foil pattern.

(b). Parts placement. Please note that this parts placement diagram is shown as viewed from the foil side of the PC board, the components mount on the opposite side of the foil pattern.

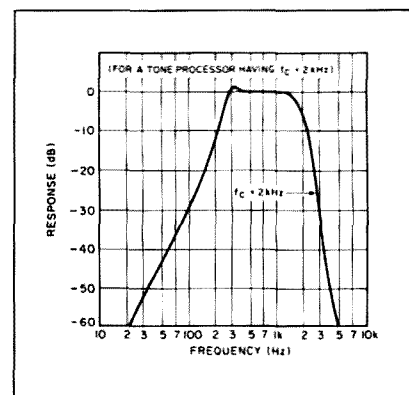


Figure 7. Tone processor frequency response characteristics.

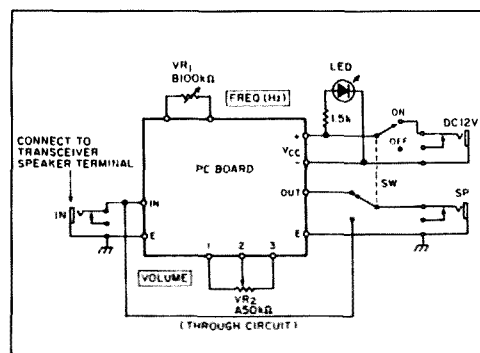


Figure 8. Hook up the tone processor between your rig's speaker output and your speaker as shown. It can be removed from the circuit with the switch.

73 Review

by Peter H. Putman KT2B

The Down East Microwave WSSK

Microwave weak signal source kits.

Down East Microwave

RR1, Box 2310

Troy ME 04987

Telephone: (207) 948-3741

Fax: (207) 948-5157

Price Class: Complete kit, \$65; assembled board, \$88; assembled in a box, \$120.

To paraphrase a current beer commercial, "Wouldn't it be great if someone made a simple, reliable and inexpensive signal source for the microwave bands?" Well, someone does, and they're called the WSS903K, WSS1152K and WSS1296K kits from Down East Microwave. All three kits can be assembled in one evening (if you're so inclined) and feature on-board interdigital filters, MMIC stages for stability, and a no-tune design.

How They Work

All three sources use a two-stage oscillator/buffer, working anywhere from 90 to 110 MHz, followed by an MMIC amplifier, diode multiplier and two additional MMIC amp stages. Output is typically in the 1-to-3-milliwatt range, which is more than adequate for aligning preamps and mixer stages. The WSS903K is designed for an output frequency of 903.100 MHz using a crystal frequency of 90.3100 MHz, while the WSS1296K pops up at 1296.100 using a 108.0833 fundamental. On the other hand, the WSS1152K is probably the most versatile of the three, with

usable harmonics all the way up to and including the 3 cm band (10.368 GHz). It can be used at 2304, 3456, and 5760 MHz as well, and for just fooling around it makes a great local oscillator (add 144 MHz, and mix to get 1296 MHz output).

Construction

Assembly is very easy. You'll need to wind four coils using a 0.1"-diameter drill bit and #24 enameled wire, supplied in the kit. Two BFX89 transistors are used in the oscillator stage, followed by a MAR-3 MMIC, an HP 2835 multiplier diode, a MAR-6 MMIC and another MAR-3 for output. About a dozen chip capacitors are included, and you'll need to use a small pair of needle-nose pliers and a low-wattage iron to solder them in place. Keep all leads as short as possible on the coils and resistors. This isn't hard to do as you can lay each component on top of the board and cut the leads according to the solder pads. I did find some variation from the coil windings in the instructions for the WSS1152, and changed L1 from 10 turns to 11 turns, gaining 3 dB more output and

putting the crystal right on frequency (96.0020 MHz).

A good frequency counter would be helpful to check the crystal and trim it in, but if you have a receiver for any of these bands and you know the calibration, just make a note on the board with permanent marker. If you want to be sure of your frequency, allow the unit to warm up and stabilize for a bit . . . say 10 minutes or so.

Down East offers an option to get a bit more "oomph" from the board by adding another MMIC stage just before the output connector. The parts for this stage (another MAR-3 MMIC, a 220-ohm 1/4-watt resistor, and a 22 μ F chip capacitor) can be ordered at the same time for a slight additional cost. You'll have to wind another eight-turn 0.1" diameter choke from #24 enameled wire as well.

In Use

Down East suggests a Radio Shack 270-238 box for installation. I would prefer to use a small Hammond or Bud die-cast box with a BNC or SMA connector and feed-throughs for

DC power. The board is small enough at 3" x 5" to fit in just about any configuration, and you could put all three together in one box with a power supply and just switch to the desired port. I've used mine to check the sensitivity of several GaAsFET preamps I use on 33 cm, 23 cm and 13 cm. Although the crystal stability would be far better with an oven, drift is pretty minimal after warm up and gives you an easy way to find yourself on any of these bands, especially if you're trying to work another microwave station on a schedule.

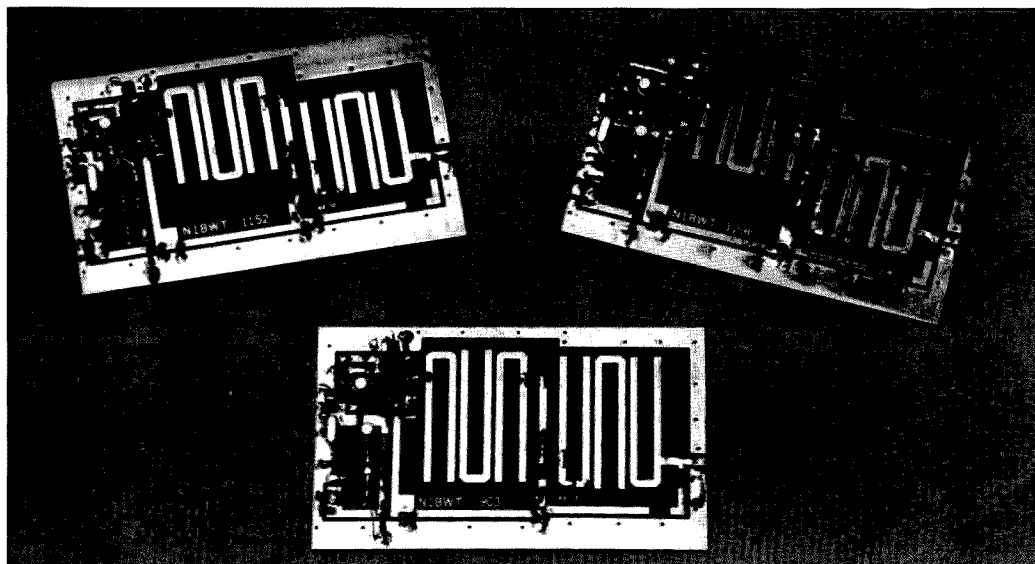
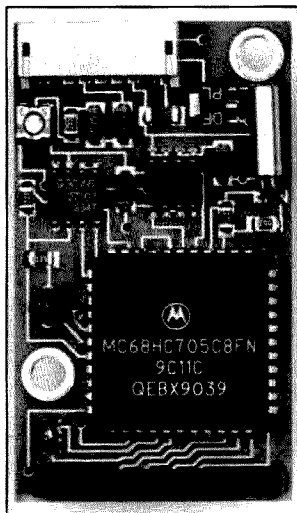


Photo A. The Down East Microwave WSS (Weak Signal Source) kits can be ordered for outputs on either 903.1 (WSS903K), 1152 (WSS1152K) or 1296 MHz (WSS1296K).

NEW PRODUCTS

Number 20 on your Feedback card

Compiled by Hope Currier



COMMUNICATIONS SPECIALISTS

The PE-15 from Communications Specialists is a miniature sub-assem-

bly capable of sending 15 separate codes in the POCSAG (RPC-1) format. The PE-15 is intended for operators of local "in-house" radio systems wishing to signal tone-only pagers. It is ideal for factories, restaurants, sales managers, security operations, oil fields, or wherever direct control of local area paging is desired. The 15 available codes may be used to activate up to 4 distinct alert tones on each pager, 15 individual pagers, or any combination thereof. Communications Specialists also makes the PE-4 four-call and PE1000P 1,000 call POCSAG paging encoders. All of these units can be used on most two-way radio systems, providing enhanced capability of existing systems at low cost.

The PE-15 and PE-4 are factory-programmed to your specific address codes, or may be field-programmed via an available keypad. They each sell for \$99.95. For more information, contact *Communications Specialists, Inc.*, 426 West Taft Avenue, Orange CA 92665-4296; (714) 998-3021, (800) 854-0547, Fax: (714) 974-3420. Or circle Reader Service No. 201.



J & W TECHNOLOGY

IRACS (Interactive Remote Alarm and Control System) from J & W Technology is a controller that allows you to perform reliable long-range remote control with your hand-held or mobile radio. IRACS is designed to connect easily to the speaker, microphone and PTT lines of any FM transceiver.

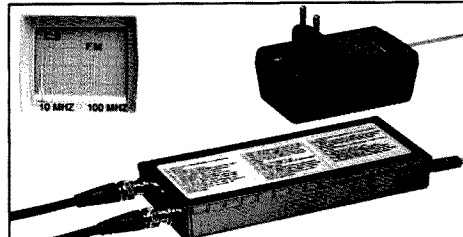
IRACS uses this transceiver to receive DTMF commands from you and to transmit acknowledgements and system status back to your handheld.

Typical uses include remote control and site alarm for your repeater site, home or car. You can use it simply to turn on a remote speaker for selective calling or to turn on a tape recorder remotely.

IRACS is available in the following configurations: fully assembled and tested, with matching case, \$149; fully assembled and tested PC board without case, \$119; complete parts kit with a single-sided PC board, \$99. For more information, contact *J & W Technology*, 38 Jade Street, Scarborough, Ontario, Canada M1T2T8; (416) 298-4499. Or circle Reader Service No. 204.

R & D ENGINEERING SYSTEMS

R & D Engineering is offering two analyzers, the AS-100 and the AS-1750. Both analyzers include power supplies and have the same specifications except that they operate in different bands: The AS-100 operates from 2.8 to 105 MHz, and the AS-1750 operates the 850 to 1750 band. The suggested retail price is \$179 for

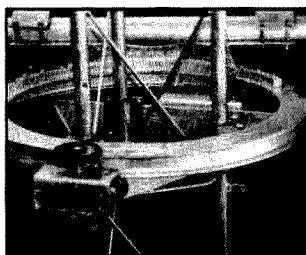


the AS-100 and \$259 for the AS-1750, plus shipping and handling. Dealer rates are available. For more information, contact *R & D Engineering Systems*, 502 Canal St., Folsom CA 95630; (916) 985-2555. Or circle Reader Service No. 202.

SAGANT ANTENNA

Arrow Line antennas from SAGANT U.S.A. for HF, VHF, and UHF are compact and lightweight, with a low radiation pattern for outstanding performance. Model AL-207F is a base-type 2m/70cm dual-bander (51" long, 0.77 lbs.) that handles 250W FM. The AL-144F is a compact base antenna for 2 meters. Other Arrow Line models for mobile, 2 meters, HF and 1.2 GHz are available. SAGANT also offers a wide range of wire antennas, such as Zepp-type and inverted V, and HF mobile antennas that are slim and short for mounting on the roof.

For prices and more information, contact *SAGANT U.S.A.*, 360 W. Bedford Ave., Suite 111, Fresno CA 93711; (209) 261-1400, Fax: (209) 261-0662. Or circle Reader Service No. 203.

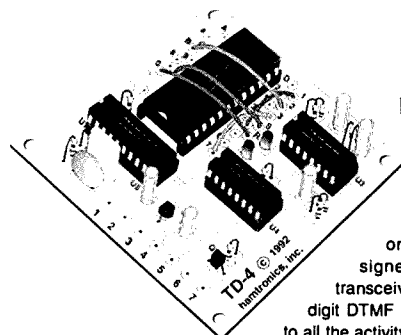
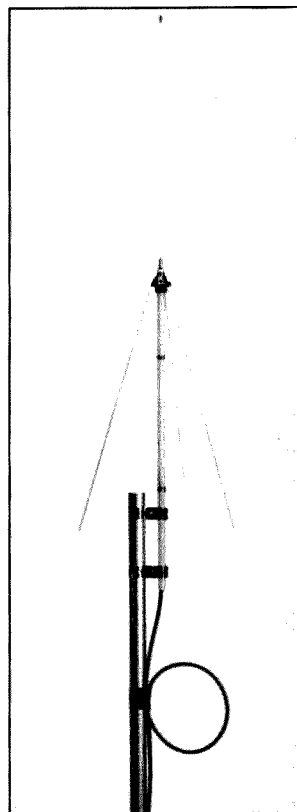


TIC GENERAL

TIC General has introduced the Model 1022 TIC Ring, downsizing the larger Model 1023 into a compact yet very powerful rotor. Far more than a rotor, this is a Ringrotor, with rugged steel ring construction, a powerful drive motor, solid worm gear braking and galvanized coating. It will mount, hold and turn large antennas. It offers an analog controller, preset, North cen-

ter, South stop, analog meter readout, memory backup, and an easy-to-read scale.

The TIC Ring Model 1022 is \$649 plus S & H. For more information, contact *TIC General, Inc.*, P.O. Box 1, 302 Third Street East, Thief River Falls MN 56701; (218) 681-1119, (800) 842-7464, Fax: (218) 681-8509. Or circle



HAMTRONICS, INC.

The Hamtronics TD-4 Selective Calling Module is a relatively new economy touch-tone decoder with one latching output. This versatile module, only a few inches square, is primarily designed to mute the speaker of a receiver or transceiver until someone calls by sending a four-digit DTMF signal, thus making it unnecessary to listen to all the activity on a channel just so someone can call you

once in awhile. It is easy to modify the latch input circuits on the TD-4 to perform the LITZ function, i.e. mute the receiver until a DTMF zero has been received for six continuous seconds, making it a low cost solution for implementing this new emergency warning scheme.

The TD-4 is only \$49 in kit form or \$89 wired and tested. For more details and a complete catalog, contact *Hamtronics, Inc.*, 65-F Moul Road, Hilton NY 14468-9535; (716) 392-9430, Fax: (716) 392-9420. Or circle Reader Service No. 205.

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Future OSCARs

The first amateur radio satellite, OSCAR-1 (Orbiting Satellite Carrying Amateur Radio), was launched into orbit just over 31 years ago on December 12, 1961. The 10-pound package sent the letters "HI" in code on 2 meters. This small unit was designed and built by members of the Project OSCAR group at Foothills College in Los Altos, California, and the Lockheed Amateur Radio Club in Sunnyvale, California. The 100-milliwatt transmitter system lasted three weeks until the batteries discharged. Over 600 amateurs in 25 countries reported reception of the signals. Since then, many more amateur radio satellites have been launched, and several from other countries are on the way.

Current amateur satellite community attention has been focused on Phase 3-D. Phase 1 OSCARs were designed for short lifetimes and low orbits. Phase 2 spacecraft are built for long lifetime (over one year) operation in low orbits. Phase 3 satellites are placed into high orbits and are usually designed with at least a five-year lifetime. Phase 3-A met a watery end in 1980 when its Ariane launcher malfunctioned. Phase 3-B became AMSAT-OSCAR-10 in 1983 and Phase 3-C was renamed AMSAT-OSCAR-13 when it reached orbit in 1988. Although Phase 3-D will be placed into an orbit similar to the other Phase 3 spacecraft, it is much larger and significantly more complex than its predecessors. Participating groups include the U.S., Germany, Belgium, Hungary, Finland, Czechoslovakia, Great Britain, Japan, South Africa, Australia and Slovenia. The main goals of the project are to improve link margins over previous satellites with more power from the satellite, to promote the use of higher frequencies for satellite communications, and to cut the cost of earth stations and retain sufficient commonality with existing hamsats to avoid obsolescence of current equipment. Launch could be as soon as 1995. Many changes have been made to the structural design of the satellite in recent months, so it will be a challenge to have everything ready in time.

Other satellite projects continue with development and construction or have been proposed for future programs. International satellites are expected soon from Mexico, Italy, Russia, France, South Africa, Israel, Chile and other countries. Here in the U.S., efforts continue on SEDSAT in Huntsville, Alabama, and at PANSAT, the Naval Postgraduate School satellite in Monterey, California.

Some programs from other countries and schools have used amateur frequencies for educational orbiting experiments. These "gray area" projects confuse the issue of what is an OSCAR and have caused serious arguments among international groups. Some have said that the French satellite SARA should be called SARA-OSCAR-23, while others

argue that SARA's operation on ham frequencies was a matter of convenience for the builders. There are also questions about UoSAT-OSCAR-14, which is still operational for commercial and educational uses but not available to amateur radio operators. While interlopers in the amateur bands should be discouraged, AMSAT organizations wish to aid and promote more ham-originated satellite work through checks of the intent of the various groups and their credentials as amateur radio organizations.

Current OSCARs

New hamsats are always exciting. They provide fresh resources for communications and experiments testing ideas from an orbital vantage point. We have seen the results of imaging advances from the early days of UoSAT-OSCAR-9's camera to the dramatic views seen and transmitted by KITSAT-OSCAR-23. Data experiments have gone from CW and RTTY to 9600 bps packet. Voice transponders have progressed from simple Mode "A" systems using the 10 meter band for a downlink to the Mode "S" system on A-O-13 that comes to earth on 2.4 GHz in the 13cm band.

In the early days of OSCAR with Phase 1 satellites, the time between satellite launches was painful since the operational time of the hamsat was usually limited to a few weeks and launch opportunities were rare. Later, with Phase 2 satellites like A-O-6, spacecraft lifetimes of several years were common. Today we have so many amateur radio satellites it is impossible for one person to keep up with them all. Most enthusiasts focus their efforts on the satellite and mode that interests them the most. Newcomers typically try the easy satellites like RS-10 and RS-12 before progressing to the challenges of the high elliptical orbits of the Phase 3 spacecraft.

It's time to take stock of the incredible resources in orbit and available for use in 1993. Rather than wait for the next round of hamsats, or the promised advances of Phase 3-D, it's time to get on the air now. The hamsats are a limited resource. When the batteries finally die, or a key transistor gives out, it's all over.

AMSAT-OSCAR-10 was launched nearly 10 years ago on an Ariane rocket from French Guiana. This satellite still performs very well on Mode "B" using a 70cm uplink and 2 meter downlink. The computer gave in to radiation damage three-and-a-half years after launch, but the transponder system still works well when the solar cells are properly illuminated. The elliptical orbit favors the Southern Hemisphere, providing excellent DX opportunities not available via A-O-13.

UoSAT-OSCAR-11 was launched from the Western Test Range at Vandenberg Air Force Base in Lompoc, California, in 1984. Nine years later it is still performing extremely well with telemetry, bulletins, digital speech and whole-orbit data transmissions. It is usually heard on 145.825 MHz FM sending ASCII data at 1200 bps. Many stations looking for D-

AO-13 PROVISIONAL MODE SCHEDULES 1993

M QST *** AO-13 TRANSPONDER SCHEDULE *** 1992 Dec 21 - Feb 08			
Mode-B	: MA 0 to MA 256 !		
Mode-S	: MA	!	
Mode-LS	: MA	!	Attitude Dec 21 130/0
Mode-JL	: MA	!	Jan 04 140/0
Mode-B	: MA	!	Jan 18 150/0
Omnis	: MA 170 to MA 15 !		
Eclipses: Transponder OFF MA 170 to 256 Jan 28 - Mar 04			
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 Feb 08 - Mar 08			
Mode-B	: MA 0 to MA 40 !		
Mode-S	: MA 40 to MA 50 !	<- S transponder; B trsp. is OFF!	
Mode-LS	: MA 50 to MA 55 !	<- S beacon + L transponder	
Mode-JL	: MA 55 to MA 70 !	Alon/Alat 150/0	
Mode-B	: MA 70 to MA 256 !		
Omnis	: MA 170 to MA 15 !	Move to attitude 180/0, Mar 08	
Please don't uplink to B, MA 40- 50. Interferes with Mode S.			
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 Mar 08 - May 10			
Mode-B	: MA 0 to MA 120 !		
Mode-S	: MA 120 to MA 130 !	<- S transponder; B trsp. is OFF!	
Mode-LS	: MA 130 to MA 135 !	<- S beacon + L transponder	
Mode-JL	: MA 135 to MA 150 !	Alon/Alat 180/0	
Mode-B	: MA 150 to MA 256 !		
Omnis	: MA 230 to MA 40 !	Move to attitude 210/0, May 10	
Please don't uplink to B, MA 120-130. Interferes with Mode S.			
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 May 10 - May 31			
Mode-B	: MA 0 to MA 180 !		
Mode-S	: MA 180 to MA 190 !	<- S transponder; B trsp. is OFF!	
Mode-LS	: MA 190 to MA 195 !	<- S beacon + L transponder	
Mode-JL	: MA 195 to MA 210 !	Alon/Alat 210/0	
Mode-B	: MA 210 to MA 256 !		
Omnis	: MA 250 to MA 60 !	Move to attitude 120/0, May 31	
Please don't uplink to B, MA 180-190. Interferes with Mode S.			
Series: 1993 May 31 - 1993 Nov 08			
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 May 31 - Aug 02			
Mode-B	: MA 0 to MA 256 !		
Mode-S	: MA	!	
Mode-LS	: MA	!	Attitude May 31 120/0
Mode-JL	: MA	!	Jun 14 130/0
Mode-B	: MA	!	Jun 28 140/0
Omnis	: MA 170 to MA 10 !		Jul 12 150/0
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 Aug 02 - Aug 30			
Mode-B	: MA 0 to MA 40 !		
Mode-S	: MA 40 to MA 50 !	<- S transponder; B trsp. is OFF!	
Mode-LS	: MA 50 to MA 55 !	<- S beacon + L transponder	
Mode-JL	: MA 55 to MA 70 !	Alon/Alat 150/0	
Mode-B	: MA 70 to MA 256 !		
Omnis	: MA 170 to MA 10 !	Move to attitude 180/0, Aug 30	
Please don't uplink to B, MA 40- 50. Interferes with Mode S.			
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 Aug 30 - Oct 18			
Mode-B	: MA 0 to MA 120 !		
Mode-S	: MA 120 to MA 130 !	<- S transponder; B trsp. is OFF!	
Mode-LS	: MA 130 to MA 135 !	<- S beacon + L transponder	
Mode-JL	: MA 135 to MA 150 !	Alon/Alat 180/0	
Mode-B	: MA 150 to MA 256 !		
Omnis	: MA 230 to MA 40 !	Move to attitude 210/0, Oct 18	
Please don't uplink to B, MA 120-130. Interferes with Mode S.			
M QST *** AO-13 TRANSPONDER SCHEDULE *** 1993 Oct 18 - Nov 08			
Mode-B	: MA 0 to MA 180 !		
Mode-S	: MA 180 to MA 190 !	<- S transponder; B trsp. is OFF!	
Mode-LS	: MA 190 to MA 195 !	<- S beacon + L transponder	
Mode-JL	: MA 195 to MA 210 !	Alon/Alat 210/0	
Mode-B	: MA 210 to MA 256 !		
Omnis	: MA 250 to MA 60 !	Move to attitude 120/0, Nov 08	
Please don't uplink to B, MA 180-190. Interferes with Mode S.			

Table 1. AMSAT-OSCAR-13 operation schedule for 1993 from G3RUH.

O-17 find U-O-11 instead since they share the same downlink frequency.

RS-10/11 is nearly six years old. Launched from Plesetsk in June 1987, this dual package is part of the larger COSMOS 1861. Andy Mirinov RS3A has acted as the primary control station from the Command Center of RS Satellites in Moscow. Andy has recently begun work at the Moscow Adventure Club, but continues with the RS control activities. RS-10 remains in excellent condition providing Mode "A" operation (2 meters up and 10 meters down) from its 1,000-km-high polar orbit. The satellite pair can be used in other modes, but "A" is primary. RS-11

is held as a back-up should a failure occur in the RS-10 hardware.

AMSAT-OSCAR-13 was one of the payloads on the June 1988 launch of an Ariane 4 series rocket from French Guiana. A-O-13 continues as the primary voice transponder hamsat. Activity is not limited to a single mode. The current schedule includes the popular Modes "B" and "J" (2 meters up and 70cm down), and also Mode "L," which uses 1.2 GHz as an uplink to a 70cm downlink, and Mode "S."

James Miller G3RUH recently posted a complete preliminary mode schedule for 1993, shown in Table 1. Up-to-date

RUDAK2>BEACON:++ Hi, this is the RUDAK-II experiment on AMSAT OSCAR 21 ++

RUDAK2>TLM-1:RUDAK-II Telemetry	(92-12-02 13:59:00):
Voltages RM1-TCMD-Interface	Lock Memory Errors
5V-R1 : 0.80 V	1-TX-ON: OFF
5V-RTX: 5.04 V	2-RX12&48: OFF
	RX2: * Single: 1
	RX3: - Multi: 0
	: OFF AGC
RUDAK2>TLM-2:5V-RAM: 4.95 V3-RNG	RX3: 143 Temperature
Total Current	4-Soft: 13.9 V
14V-I :	315 ma
	RX4: 207 21.6 deg C
RUDAK2>BEACON:RUDAK-II Schedule:	Downlink 145.987
UTC (Min. MOD 10)	Uplink/MHz
0...8 Beacon Mode	435.016
9 FM Repeater	no
AFSK Telemetry	

RUDAK2>BEACON:++ Hi, this is the RUDAK-II experiment on AMSAT OSCAR 21 ++

RUDAK2>BITFAT-1:S^BXH@

RUDAK2>BITFAT-2:

RUDAK2>BITFAT-3:

RUDAK2>BITFAT-4:

RUDAK2>EPROM:RUDAK-2 EPROM-Test

Table 2. Example of A-O-21 AX.25 AFSK FM data received on 148.983 MHz by N2AAM.

information about A-O-13 operations is always available via the A-O-13 telemetry beacons on 145.812, 435.658 and 2400.646 MHz in CW, RTTY and 400 bps PSK. Active command stations include Peter DB2OS, James G3RUH and Graham VK5AGR. Messages to these volunteers about A-O-13 operations can be sent via the Internet (callsign@amsat.org) or via Compuserve (>INTERNET:callsign@amsat.org). They also get mail via U-O-22. Computer predictions still show a projected reentry of late 1996 for A-O-13.

Several special interest groups can be found on specific frequencies when

the appropriate mode is on, but unlike HF, interference is light. The VHF, UHF and microwave signals are not subject to band conditions. DX chasers can be found on 145.890 MHz almost daily. AMSAT schedules operations nets on 145.950 and 435.970 MHz, and directly afterwards on the same frequencies are SSTV nets.

The MICROSATS, Pacsat-OSCAR-16, DOVE-OSCAR-17, Weber-OSCAR-18 and Lusat-OSCAR 19 were launched on January 22, 1990, on an Ariane 4 rocket from French Guiana with UoSAT-OSCAR-14 and UoSAT-OSCAR-15. U-O-14 is no longer performing amateur

radio service and U-O-15 failed shortly after launch.

The microsats P-O-16 and L-O-19 are currently operational with 1200 bps (potentially capable of 4800 bps) flying mailbox activity. The uplinks are on 2 meters FM with 70cm PSK (phase-shift keying) downlinks. Software changes are uploaded to provide enhanced operation. These satellites also provide terrestrial packet forwarding services.

DOVE-OSCAR-17 is functional but has not spent much time with the popular 2 meter downlink on 145.825 MHz. Efforts by WD0E and others have focused on restarting the 2 meter 1200 bps AX.25 FM telemetry. DOVE stands for Digital Orbiting Voice Encoder and was sponsored by AMSAT Brazil, or BRAMSAT. Since launch, the goal was to send digitized voice messages through the satellite for educational purposes. DOVE has only spoken once and it was with limited fidelity. Those efforts will continue.

Weber-OSCAR-18 continues to take pictures of the earth. This satellite was primarily built by Weber Band University in Ogden, Utah. It is slightly taller than the other microsats since it has a camera "penthouse" on top. Images of Peru, Chile, Northern Australia and the southern tip of India were targets for the winter season. The images are sent to earth at 1200 bps using PSK on 70cm. WEBERWARE software is used to collect the received data and display the results. Students at Weber State have also been studying battery telemetry and other data available from the satellite.

Comparisons of battery data from just after launch to the present will provide valuable information for future microsats.

Fuji-OSCAR-20 was sent to orbit from the Tanegashima Space Center in Japan on February 7, 1990. It replaced the older F-O-12, which lasted about three-and-a-half years. F-O-20 has both a linear Mode "J" transponder (Mode "JA") and a digital mailbox system (Mode "JD") at 1200 bps PSK. The satellite spends most of its time in "JD" but is scheduled for "JA" operation on Wednesdays, UTC. Signals are

strong but careful management of the satellite's power budget and temperature by ground control stations is necessary.

RS-14 went to orbit on January 29, 1991. It is also known as RADIO-M1, RUDAK-2 or AMSAT-OSCAR-21 and is attached to the Soviet INFORMATOR-1. While its linear Mode "B" transponder was very popular at first, today the FM "repeater" mode of the German RUDAK (Regenerative Transponder for Digital Amateur Radio Communications) experiment has sparked the interest of many new satellite chasers. Telemetry and the FM voice (uplink on 435.016 MHz) mode share portions of each 10-minute period. When the system is not acting in the repeater mode, the telemetry can take on many forms, including 1200 bps AX.25 AFSK, 400 bps PSK or even digital voice. Messages of greeting in different languages and even a "get well soon" message sent to Matjaz Vidmar YT3MV have been heard on the RUDAK downlink of 145.983 MHz. Table 2 shows an example of recent AX.25 packet telemetry from RUDAK. The signals were monitored by Dave N2AAM in early December.

RS-12/13 was launched on February 4, 1991, aboard the COSMOS-2123 NAVSAT. COSMOS-2123 is a replacement for COSMOS-1861, which carries RS-10/11. The RS-12/13 package is capable of the same linear transponder modes as RS-10/11, but is most commonly found with RS-12 active in Mode "K," which uses a 15 meter uplink and a 10 meter downlink. Signals are usually strong. Most users call "CQ RS" when accessing the satellite to avoid confusion with other terrestrial 15 meter activity. Many more years of service are expected from RS-12/13, based on the results of RS-10/11.

UoSAT-OSCAR-22 joined the now large group of hamsats on July 17, 1991, primarily as a replacement for the failed U-O-15. After complete commissioning, it has taken over the 9600 bps duties of U-O-14. In addition to serving as a packet mailbox eight times faster than the microsats, it also has a camera experiment on board and has taken some excellent shots of the earth. The 70cm transmitter is not as clean as that of U-O-14 but, with today's modems, copy is very good for the several hundred regular users. Significant amounts of terrestrial packet messages are forwarded through the satellite and its health has been excellent. Messages, programs, pictures and even voice mail have been sent via U-O-22.

Kitsat-OSCAR-23 joined the amateur satellite corps on August 10, 1992. It has a 9600 bps system very similar to U-O-22, but with better transmitter characteristics. The camera system is more sophisticated, with both wide and narrow angle lenses and has provided some fantastic images from space. The mailbox system was released for general use this winter. The orbit is slightly higher than the other University of Surrey-built spacecraft and gives more access time per pass. Some newcomers to satellite packet activity have found the 9600 bps FM mode of the UoSATS and Kitsat less expensive than the 1200 bps PSK mode of the microsats. The link margin advantages of PSK versus FM are overcome by excellent signal levels from the FM satellite transmitters.



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CIRCLE 110 ON READER SERVICE CARD

by David R. Margolis AG8L

The GAP Voyager DX-IV Vertical

Operate 160 through 20 meters with this high performance antenna.

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Vero Beach FL 32967

Telephone: (407) 778-3728

Price Class: \$390; guy rope, \$39.

For the last two years I've been DXing with 100 watts and two verticals, the Cushcraft R5 and the GAP Challenger DX-VI. The GAP DX-VI is a fine antenna, but its performance on 80 meters is limited by its size and narrow bandwidth. I wanted something better for 80, and also some way to get on 160 meters. Dipoles seemed like a poor choice because of the difficulty in getting them to an effective height. At the 100 watt power level 80 and 160 meters are especially difficult because of the typically higher noise levels and weaker signal strengths, so an effective antenna is a must.

Enter the GAP Voyager DX-IV, the big brother to the GAP DX-VI. The DX-IV is 45 feet tall and covers 160, 80, 40 and 20 meters. The DX-IV was created specifically to provide an antenna solution on 160 and 80 meters; the coverage of 40 and 20 meters is something of a bonus. About 90 kHz is covered on 160 meters, with full coverage on the other bands.

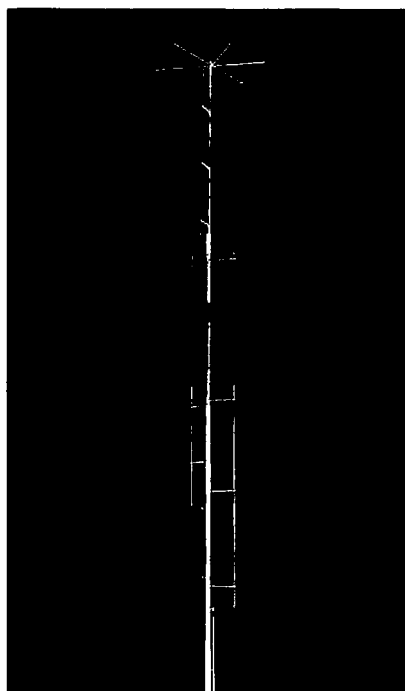


Photo A. The GAP Voyager DX-IV offers 160 through 20 meter operation.

Description

If you're not familiar with GAP verticals, picture a dipole mounted on end. That is the best way I have to describe the GAP DX-IV to you. The feedline attaches to a center insulator (the "GAP") about halfway up the antenna. From there, the feedline comes down inside the lower section of the antenna and exits through the bottom, terminating in a PL-259 connector. Tuning rods attach to three sides of the antenna to provide multiband coverage, and a capacitance top hat (a wire ring six feet in diameter) at the top of the antenna increases the electrical height for 80 and 160 meters.

Unlike traditional verticals, an extensive ground radial system is not required. Only three radials (the manufacturer calls them counterpoise wires) measuring 57 feet are required. The only restrictions on them are that they must be insulated, and they must not run too close to your feedline. They can be buried, and they can zigzag, if necessary, to fit your site. You'll need to provide the wire (it doesn't come with the antenna), but just about any insulated wire will do fine.

I had my DX-IV shipped to my office. It can be shipped by UPS, but you should be prepared to receive a long box. I got some sense of this when the receptionist called and told me, with a note of panic in her voice, that there was an antenna for me in the lobby. She didn't sound too happy. The box is nine feet long, which is the longest allowed by UPS, and weighs about 30 pounds. I managed to get it home in my Taurus by running it diagonally through the car with one end sticking out the front passenger window. If you try this during rush hour, remember to stay on the left side of your lane.

When you unpack the box, you will find several large pieces of tubing, the GAP section with pre-attached coax, and many smaller pieces of tubing. The smaller pieces of tubing are packed inside the larger diameter tubing for protection during shipping. A small box of hardware, the top hat wire, instructions, and a nut driver round out the parts inventory.

Before You Start . . .

Before the antenna can be put up, several things must be done. A suitable site is the first requirement. You'll need a clear area at least 45 feet long with no obstructions (like tree

branches or electrical wires) above it. Four pairs of guy ropes spaced 90 degrees apart support the antenna and attach to the ground 25 feet from the base of the antenna, so the 45-foot figure should really be closer to 70 feet to take this into account. The location of the counterpoise radials should also be considered when selecting a site, although you have more flexibility with their placement. The tuning rods at the bottom of the antenna will be hot with RF during use, so an enclosure should be included if children or pets can enter the area.

Another site consideration is the proximity of other vertical metal objects. Allow at least 70 feet separation from towers, other vertical antennas, aluminum-sided buildings, and so forth. My GAP DX-VI antenna is the closest metal object to the DX-IV, at a distance of just over 70 feet, and it has not caused any problems.

The second requirement is to obtain suitable guy ropes. I assumed this would be easy as I ordered them with the antenna. Unfortunately, the rope was out of stock and had to be back-ordered. With a major contest quickly approaching, I was determined to get the antenna up, so I looked for suitable rope locally. Despite being in a major metropolitan area, I was unable to find a good replacement. The guy rope for the antenna should be rated for 300 pounds load, have good UV resistance, and not stretch under tension. This combination of requirements is almost impossible to find in hardware store rope. I settled on a 240-pound-rated Poly (polypropylene) rope, but I used it knowing that it would need replacement within a season due to its poor resistance to sunlight. The 300-pound load rating will keep the antenna standing in a 80 mph wind, so you can get by with something less for temporary use, like Field Day. You'll need 350 feet of rope in all, cut into eight pieces during assembly for the eight guy ropes.

You can use a variety of ground anchors for the guy ropes. I took a different approach as I didn't want to give up any lawn space to the guy ropes angling down from the antenna. Instead of ground anchors, I placed four 10-foot treated 4x4s in the ground, 25 feet from the base of the antenna, spaced 90 degrees apart. The 4x4s were buried four feet deep and anchored with one bag of ready-mix concrete each. Screw eyes were placed about 5-

1/2 feet up each 4x4 to hold the guy ropes. With this system, the guy ropes don't get in the way when you mow the lawn. More importantly, since the guy ropes are the only thing keeping the antenna up, they are much better protected from accidental damage. I found bite marks recently in the coax that runs to one of my antennas. Unbelievably, the bite penetrated all the way through to the inner conductor of the 9913 (large size) coax. So consider the "critter" factor when deciding how to locate the guy ropes.

The antenna sits on a base mount made of two pieces of angle iron. The bottom of the antenna sits between the base mount and pivots on a bolt. Although the base mount can just be pounded into the ground, I installed mine in concrete. One bag is plenty if you decide to go this route. If you decide to use 4x4s as guy mounts as I did, the base mount should be turned about 10 degrees instead of lining up directly with the 4x4s. Otherwise, one of the 4x4s will be in the way when you try to raise or lower the antenna.

Assembly

Assembling the antenna is quite easy. There is little to measure; most pieces just slide together and connect with screws through pre-drilled holes. The tuning rods are a little less precise. Clamps are used to hold standoff insulators to the main mast, and you must position the clamps. Labels attached to the main mast get you in the ball park. An adjustment step later in the instructions helps

you compensate for any inaccuracy. The instructions are adequate, although the supplied 3-D sketch of the assembled antenna is not very detailed and could be improved.

I had a few problems. A short wire was missing (promptly replaced by GAP). The labels for the standoffs on one mast section were reversed, causing the tuning rods to be out of position. This was caught and easily corrected during the adjustment step previously described. The top hat wire (which comes to you as a closed loop) had a knot in it. I just pulled the knot tight (although this requires pliers because the wire is copper-clad steel). The rods that hold the top hat were difficult to insert through the holes in the main mast (corrected by slightly increasing the size of the holes with a pocket knife).

The most disturbing problem was finding out that the pivot holes at the bottom of the antenna were 90 degrees off their correct position. When you assemble the antenna as it lies on the ground, tuning rods extend away from the top and both sides of the main mast. In this position, the bolt that goes through the pivot holes at the bottom should be parallel to the ground. This way, you can just attach the base of the antenna to the base mount and walk the antenna up. With mine, the antenna would have needed to be rotated 90 degrees, and the tuning rods on the side prevent this.

With some head scratching (and being further motivated by falling snow), I found an easy solution. I unscrewed the base section from the sleeve that connects it to the next section (two screws), rotated it 90 degrees, drilled two new holes in the sleeve, and refastened it. Bingo. Easy fix. I talked to GAP later to review the structural impact of my field modification (no problem), and to find out what had happened. Apparently there was no coordination of holes between the top and the bottom of the base piece, and it usually just worked out OK. They plan to check this better in the future.

Raising the Antenna

With the assembly completed and the site prepared, it was time to raise the antenna. I had three helpers, although you could get by with two—two people should walk the antenna up while the third fastens the guy ropes. Walking the antenna up must be done very slowly. My dad was helping and he was certain that the top of the antenna was going to snap off, but the antenna has been designed to handle this, provided you don't go too fast and let the end whip about. After the antenna is vertical and the first set of guys are attached, you can relax a bit. With both the top and bottom guy ropes attached, the antenna is quite stable and the Individual guy ropes don't seem to be under much tension. We had problems because a few of our guy ropes had been routed the wrong way and made contact with the tuner rods, but we were able to correct this without taking the antenna down by threading the offending guy ropes through the tuner rods with a long pole while standing on a stepladder.

Performance

How does the antenna work? My first two CQs on 160 brought replies from stations about 500 miles away and 589 signal reports. On 80 meters a short time later I worked a 6W in Senegal through a pile-up. During an SSB DX contest, and using just 100 watts, I worked about 10 countries on 80 meters and 30 countries on 40 meters during the contest weekend. My country total on 80 meters has been steadily climbing, and getting through on 40 meters has been a breeze.

Compared to the GAP DX-VI, the Voyager DX-IV not only adds 160 meters capabilities, it provides several S-units of transmit improvement on 80 meters. I often heard stations before on 80 meters while using the DX-VI but they didn't hear me calling them. With the DX-IV, I usually get through. On 40 and 20, both antennas seem close, with the DX-IV getting the edge by a slight margin. Both are great DX antennas for 40 meters. On 20, I usually use the Cushcraft R5, but to be fair, I have it mounted up on the roof of the house where it has a significant height advantage. On the other hand, the GAP antennas are usually much quieter than the R5 (the difference can be like turning on a noise blander, with noise sometimes dropping as much as five S-units), so sometimes the GAP antenna is the only way to go.

The GAP DX-IV met the manufacturers SWR specifications without difficulty. As assembled, I had a usable frequency span on 160 of 1.800 to 1.895 MHz, full band coverage on 80 with 1.7:1 as the highest SWR at the band edges, full band coverage on 40 with 1.6:1 as the highest SWR at the top end of the band, and full band coverage on 20 meters with 1.3:1 as the highest SWR.

Long-term reliability of this antenna should be excellent. Except for a small encapsulated tuning device at the top of the antenna for setting the frequency coverage on 160 meters, everything else is tubing and wire. There's not a whole lot that can go wrong with this antenna, and nothing that couldn't be easily repaired in the field.

Customer Service

Customer service at GAP Antenna Products is excellent. I have talked to several different folks there, and they all were knowledgeable about the product and eager to please. Even though I purchased the DX-IV through their distributor, Amateur Electronic Supply, I received complete support direct from GAP, with no questions asked. It is rare to find a company where the employees have such enthusiasm for their product and treat their customers so well.

Conclusion

If you want a single package providing access to 160 meters, great DX performance on the entire 80 and 40 meter bands, and coverage of 20 meters as a bonus, the GAP Voyager DX-IV is your antenna. Great performance, a rugged design, wide bandwidth and superior customer service add up to an outstanding product.

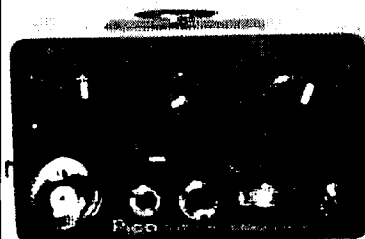
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Using the NE-602 IC in Ham Circuits

The Signetics NE-602 integrated circuit is one of those few devices that strike the imagination because it is well conceived and behaves like it's supposed to. That latter attribute means that it will work well when amateurs design and build circuits without the aid of SPICE tools or an engineering degree. One of the other chips I place in that category is also a Signetics product: the venerable 555 IC timer.

The NE-602N is an active double-balanced mixer (DBM) based on a transistor circuit called a "transconductance cell." It also contains internal power supply regulation and an oscillator transistor. The DBM works to 500 MHz, while the local oscillator

works to 200 MHz.

Figure 1 shows the pinouts of the NE-602 8-pin miniDIP device. Pins 1 and 2 form inputs "A" and "B," respectively. In single-ended circuits, input "A" is typically used, while input "B" is decoupled to ground through $0.05\ \mu\text{F}$ or $0.1\ \mu\text{F}$. In differential or push-pull input circuits, both input "A" and input "B" are used. The push-pull outputs are pins 4 and 5. Again, both single-ended and push-pull configurations are accommodated. The local oscillator transistor base and emitter are brought to the outside world via pins 6 and 7, respectively. The DC power connections are pin no. 3 for signal and DC ground, and pin no. 8 for +V DC. The DC power supply should be less than +7 volts, or regulation provided.

Figure 2 shows the DC power configuration for the NE-602. In this circuit it is assumed that a higher voltage (e.g. +12 volts) is being used, so a voltage regulator is provided to reduce it to a stable +5 VDC. The regulator can be one of those little 78L05 100-mA IC devices because the NE-602 is not exactly a current hog. A 100-ohm series resistor is used to limit current and improve decoupling. At the power terminal of the NE-602 (pin no. 8), there are

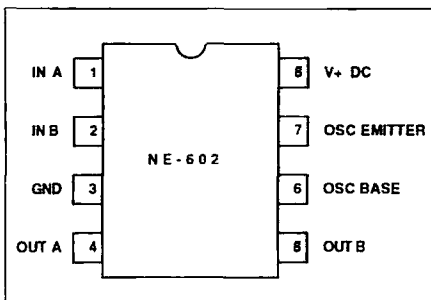


Figure 1. Pinouts of the NE-602 miniDIP package.

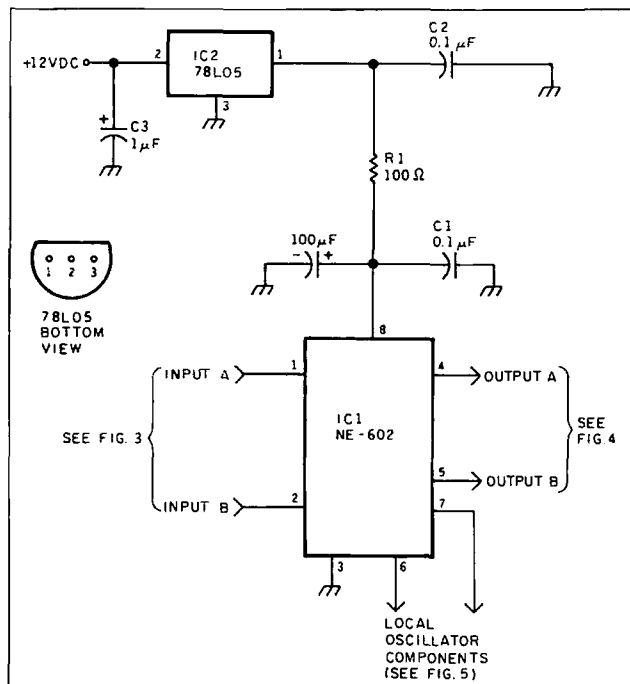


Figure 2. DC power supply circuit for the NE-602.

two decoupling capacitors: a $100\ \mu\text{F}$ unit for low frequencies and a $0.1\ \mu\text{F}$ unit for higher frequencies. I've used just the $0.1\ \mu\text{F}$ unit with no problems, but I note that most articles on the NE-602 tend to include both capacitors.

You can use a +9 volt DC power supply if a 1,000-ohm resistor is used for R1. The goal is to keep pin no. 8's voltage less than +7 VDC when about 15 mA is drawn. Even so, I recommend that the 78L05 device be used instead of depending on a voltage-dropping resistor.

Input Circuits

Figure 3 shows several input configurations. These circuits are quite varied, and which to use depends somewhat on application and somewhat on preference and convenience. For untuned or high impedance applications, use the direct input circuit shown in Figure 3A. This circuit capacitor couples signal to pin no. 1, and decouples pin no. 5 through a capacitor. The signal level applied to pin no. 1 should be less than 200 mV peak-to-peak.

An untuned differential circuit is shown in Figure 3B. This circuit uses an RF transformer that is not tuned for the input signal coupling. I've

used two forms of transformer. First, I've salvaged or adapted, as you prefer, 10.7 MHz IF transformers intended for FM IF amplifier service in transistor radios. The tuning capacitor on the secondary of such transformers can be easily removed in most cases. It is located external to the base of the transformer, in a small recess in the bottom. A small screwdriver or sharp pointed tool will allow access where the capacitor can be crushed into oblivion. The other approach is to wind a toroidal core. I've used the Amidon T-50-2 and T-50-6 cores in 75/80, 40 and 20 meter NE-602 receiver applications with good success. Each core was wound with about 20 turns of #26 AWG enameled wire on the secondary, and about four turns of the same wire on the primary.

The same sort of transformer can be used for the tuned variant shown in Figure 3C. In this particular instance the tuning capacitor floats across the secondary of the transformer. This method works when the capacitor is a trimmer type, or can be insulated from ground. But most variable tuning capacitors are designed to be grounded when mounted to the chassis, so a circuit similar to Figure 3D must be used. In this case, the

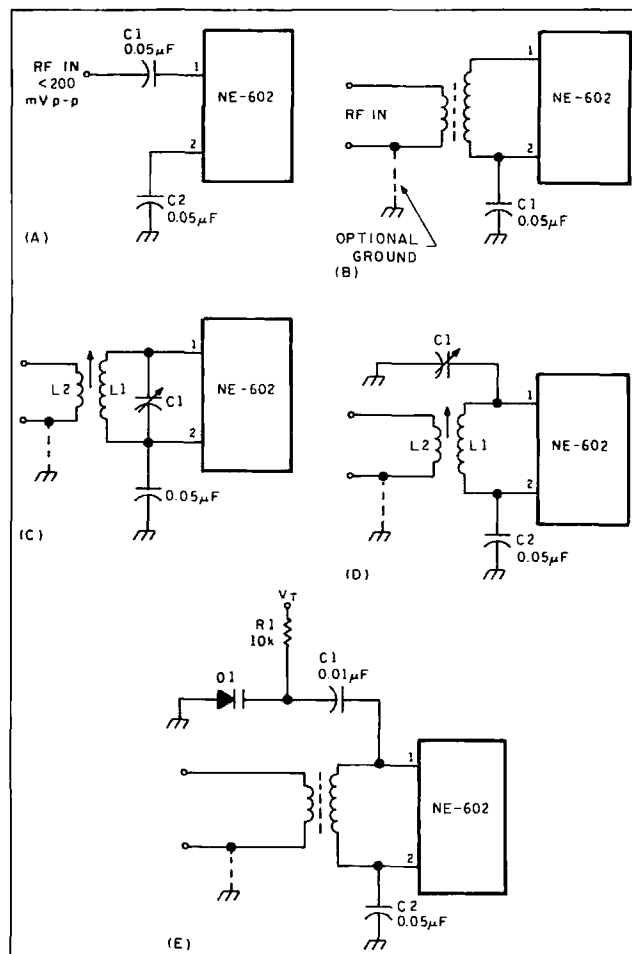


Figure 3. Input circuits for the NE-602.

tuning capacitor is connected from pin no. 1 of the NE-602 to ground. As long as C2 has a value that is considerably larger than the value of C1, the circuit will tune very much like that of Figure 3C.

Finally, given that air dielectric capacitors are hard to find, and often quite costly when available, a varactor-tuned variant is shown in Figure 3E. This circuit uses a voltage-variable capacitance diode to tune the transformer. A tuning voltage Vt from a potentiometer will set the resonant frequency of the circuit.

Output Circuits

Figure 4 shows typical output circuits. Again, several variations are shown. In Figure 4A, the untuned single-ended output circuit is shown. This circuit capacitor couples the signal from either pin no. 4 or pin no. 5 (it rarely makes any difference which) to the rest of the circuit. A balanced output transformer version is shown in Figure 4B. This circuit can use an ordinary IF transformer that matches the 1,500-ohm output impedance, or be specially wound for other applications. A single-ended tuned circuit is shown in Figure 4C. This circuit uses a parallel-tuned resonant tank circuit connected with one end to either pin no. 4 or pin no. 5 of the NE-602, and the other end to V+. Although the output signal is taken from a link winding (L2) on the tuning inductor (L1), it is also possible to capacitor-couple the output with the tank circuit in place. In either event, the output frequency selected will be that of the resonant tank circuit.

"The NE-602 is one of those well-designed little chips that has a lot of amateur radio uses."

In most modern receivers a ceramic, crystal or mechanical filter is used for the IF resonator. Connection of these types of filters is shown in Figure 4D. Resistors R1 and R2 are set to match the impedance of the filter.

The internal local oscillator can be used in either VFO or XTAL configurations. Figure 5 shows several variations on the theme. The circuit in Figure 5A is a crystal-controlled Colpitts oscillator. The two capacitors are semi-critical. The values of these capacitors should be on the order of:

$$C1 = \frac{100}{\sqrt{F_{\text{MHz}}}} \text{ pF} \quad [1]$$

and,

$$C2 = \frac{1,000}{F_{\text{MHz}}} \text{ pF} \quad [2]$$

Although these equations give the impression of a fair degree of precision in the matter of capacitor val-

ues, I've found that they are only semicritical. In one NE-602 oscillator that I built I found that changing the crystal frequency more than an octave (i.e. 2:1) did not overly disturb the operation. Those capacitors should be some sort of low tempco type, however, such as polystyrene, silvered mica or NPO ceramic (these same capacitors can be used for any of the oscillators shown here).

The rest of the circuits in Figure 5 are variable frequency oscillators (VFOs). The circuit of Figure 5B is a parallel resonant Colpitts design. Note that the parallel resonant tank

circuit (L1/C1) is tied on the "cold" end to either V+ or ground (and it doesn't seem to matter which). The other capacitors in the circuit are selected similarly to those of the crystal oscillator, except that C2 is a 0.01 μF unit.

A Hartley variant is shown in Figure 5C. This circuit uses a tapped inductor for feedback. The capacitors in the circuit (C2 and C3) are 0.05 μF disk ceramic or polystyrene devices. The tuning capacitor is an air variable with a grounded frame.

Another VFO circuit is shown in Figure 5D. This circuit has worked well from 80 meters up through 20 meters. It is based on the use of a varactor ("voltage variable capacitance diode") capacitor. The capacitance of this diode is set by the level of tuning voltage Vt applied to the reverse biased junction of D1.

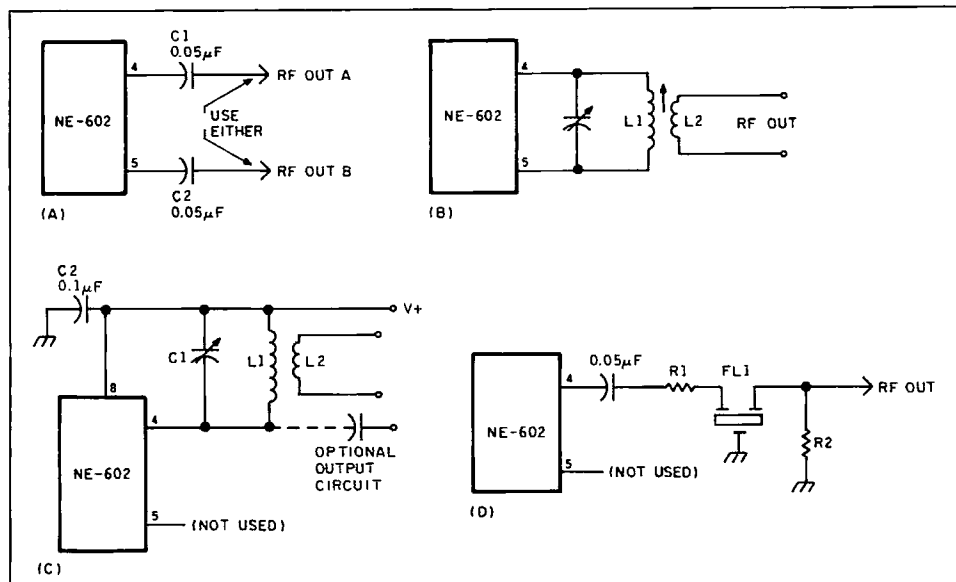


Figure 4. Output circuits for the NE-602.

The NE-602 is one of those well-designed little chips that has a lot of amateur radio uses. Space does not allow us to go further in depth on the device. I am currently writing a book for TAB called *Mastering RF Circuits* (the actual published title may be a little different, but the "Mastering" part will remain because it is part of

a series). It will deal in depth with the NE-602 and certain related chips. In the meantime, I would be interested in hearing from readers who have used the chip. Please relate your experiences and any novel uses for it. You might see your name in print if the application is interesting to a broad spectrum of readers.

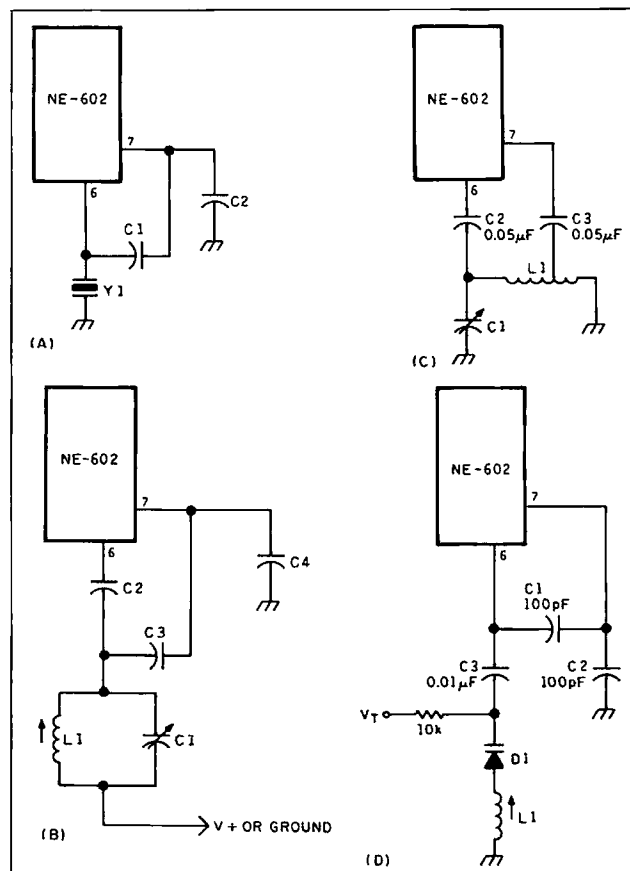


Figure 5. Local oscillator circuits for the NE-602.

Radio Direction Finding

Joe Moell, P.E., K0OV
P.O. Box 2508
Fullerton CA 92633

A Computer on Your Team

Part of the attraction of ham radio as a hobby is the opportunity to use new gadgets to communicate. Hams were among the first to embrace the personal computer as a tool. PCs send and receive CW, RTTY, packet, AMTOR, and SSTV. They log contests, design antennas, and predict band openings. And now resourceful hams are using them to help win radio direction finding (RDF) contests, sometimes called foxhunts or T-hunts.

Last month you saw how Albuquerque T-hunter Jerry Boyd WB8WFK uses a continuously-turning potentiometer at the bottom of his mobile antenna mast to drive a "heads up" direction display on the dashboard (Photo A). The azimuth reading, S-meter voltage and some other signals go to an interface box for digitizing. A laptop computer crunches the data and displays a polar plot of amplitude versus direction on the computer screen. The polar display makes it easier to sort through multipath and noise to find the best bearing to the hidden T.

Although this isn't a project for beginners, WB8WFK's design is straightforward. Hams with a moderate amount of experience with analog and digital circuits can readily reproduce it or adapt it to their own T-hunting needs. This month, we'll examine Jerry's design in greater detail.

Bearings Into Bytes

Figure 1 is the schematic for the analog-to-digital (A/D) circuitry. Each of the eight analog inputs (three are unused at present) passes through an RC filter (R1-8/C1-8) to remove high frequency noise. The filters are on a small circuit board near the BNC analog input connectors.

Filter outputs (even-numbered pins of J2) go via ribbon cable to the main board and into U5, a CD4067 analog multiplexer (MUX). Odd-numbered pins are grounded to minimize noise pickup. Inputs D0 through D2 select the channel address. Only eight of the 16 inputs on the CD4067 are used.

U4 is a National Semiconductor ADC0801 8-bit A/D converter. R3, R4, D1, and D2 provide input protection. Input/output connections to the microcontroller board are made through P1.

U1 and U2 perform address decoding. The A/D is placed at microcon-



Photo A. Jerry Boyd WB8WFK is ready to go T-hunting with his yagi connected to a digital bearing display system. His analog display and interface box are on the dashboard.

troller address \$8000 hex. Since only address lines A12-A15 are decoded, the ADC0801 responds to addresses from \$8000 to \$8FFF. The A/D is the

only hardware in this I/O address space. To start a conversion, the microcontroller program writes to address \$8000, then reads from the

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PD-144N-2FM						
	144-148 Mhz.	Preamp	Yes	FM	4-5 watts = 60W	T/R 175
PD-220N	222 Mhz.		No	FM	4-5 watts = 35W	T/R 119
PD-440N	420-450 Mhz.		No	Linear	1/2 or 4-5W = 18W	T/R 119
PD-440N-1			Yes		1/2 or 4-5W = 18W	T/R 143
PD-440N-1			No		1/2 or 4-5W = 35W	T/R 155
PD-440N-1			Yes		1/2 or 4-5W = 35W	T/R 179
PD-440N-2			No		1/2 or 4-5W = 60W	T/R 285
PD-440N-2R			No		1-4W = 60W	T/R 199
PD-440N-1			No		3-4W = 60W	T/R 235
PD-440NM			No		1/2 W = 6W	T/R 75
PD-440NM			No		1/2 W = 6W	T/R 118
PD-900N	902-928 Mhz.		No	FM	1/2 W = 10W	T/R 65
PD-900N	902-928 Mhz.		No	FM	1/2 W = 10W	T/R 90
PD-331HP	902-928 Mhz.		No	Linear	1 W = 18W	T/R 265
PD-331HP			No		1 W = 16W	T/R 299
PD-331P			No		1 W = 6.5W	T/R 119
PD-331P-1			No		6 W = 15W	T/R 125
PD-331P-1			No	Hybrid	5mw = 8W	T/R 123
PD-331P-1			No	Linear	1/2 W = 1.5W	T/R 59
PD-33 Doubler	70 cm. = 33 cm.				1/2 W = 1.5W	T/R 65
PD-33 Doubler	70 cm. = 33 cm.				1/2 W = 1.5W	T/R 85
PD-1200N	1.2 Ghz.	Preamp	No		1 W = 18W	T/R 149
PD-1200N-2	1.2 Ghz.		No		1 W = 16W	T/R 205
PD-1200N-3	1.2 Ghz.		Yes		1 W = 16W	T/R 299
PD-1200N-1	1.2 Ghz.		No		3 W = 36W	T/R 285

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same address to get the data.

The A/D's INTR line is connected to memory-mapped port B7. The microcontroller can read this bit to determine if data is ready after a start command. This is not necessary with BASIC programs, but would be needed if a machine code program is used in the future. Jumper JK2 is included to disable this function. Jumper JK1 allows a test voltage from R2 (read at TP1) to be fed to the A/D.

Jerry uses a Micromint model BCC11 computer/controller, which contains a Z8 CPU. It also has a Tiny BASIC interpreter, 6K bytes of RAM and EPROM, one RS232 port, and two parallel ports. It costs \$139 and is available from Micromint, 4 Park Street, Vernon CT 06066; (203) 871-6170. If you don't want to build your own MUX-A/D circuit, Micromint sells an 8-bit 8-channel MUX-A/D board for \$129.

The Z8 board requires 5 volts at 250 mA for the logic and +/-12 volts at 30 mA for the RS-232 port. You'll need a regulator to supply 5 volts to the microcontroller and A/D board. Small DC-to-DC converters are available to supply -12 volts.

The digital circuitry could produce RFI on 2 meters. WB8WFK had no problems on his local hunt frequency (146.565 MHz), but has "birdies" elsewhere on the band. If this bothers you, check to see if the problem comes from the laptop or the A/D box. Try EMI filters on the power supply and

analog inputs. Use good shielded cable for the RS232 link. Powering the system from a battery separate from the vehicle may also help.

Upon starting the program, the PC downloads the Z8 control program from disk to the BCC11 via the RS-232 port at 4800 bits per second. Then it sends a run command to start the BCC11 and displays the main menu.

Jerry prefers the Tiny BASIC method of Z8 programming. "You could burn the program into the on-board 2732 EPROMs," he says. "That would allow faster link speed. But it's nicer doing it my way. On the first hunt, I found something I needed to change. So I typed in a mod to the program file on the PC and reloaded it on the fly."

"You can use any microcontroller instead of the BCC11," he continues, "as long as the software looks like the host mode of a TNC. My PC software sends a command, the Z8 interprets

the command and sends back the data in the format that the PC wants. It would be easy to rewrite the PC software to go with another microcontroller because command definition is simple. For instance, when you go into data acquisition, my software sends a '3' to the controller and it sends back the data packet. There are similar commands for the other modes.

"One thing to watch out for is that the PC software needs a routine to

flush out stuff that's echoed from the microcontroller. For example, the BCC11 echoes the command, carriage return, line feed, a question mark and a space. My software strips that stuff out."

Crunching the Data

A computer with 386 CPU is best for the display because of its high speed. WB8WFK and KA8JMW have experimented with an inexpensive Ky-

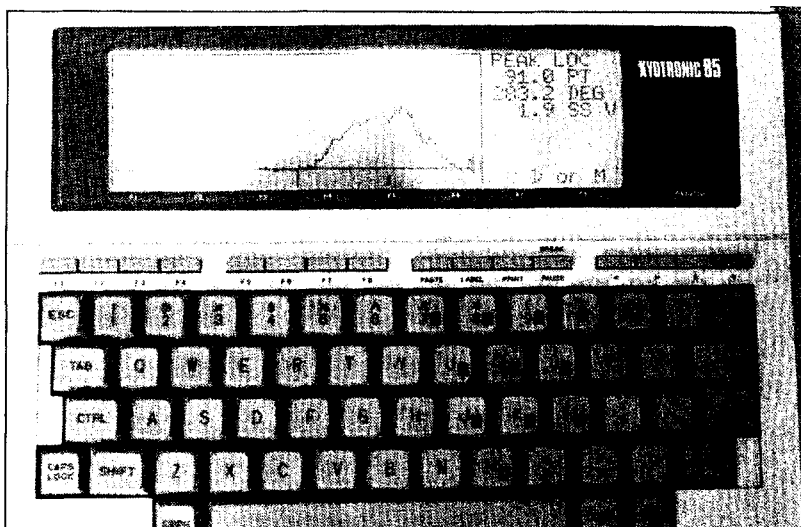


Photo B. Inexpensive laptops such as the Model 100 clone can display bearings. The screen resolution is good enough for an X-Y plot of signal strength versus azimuth, but not a polar plot.

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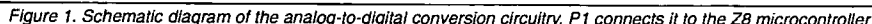
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In addition to the Data Acquisition and Playback modes, WB8WFK has added two new modes, selected from the main menu. In the Calibration Mode, the PC instructs the Z8 to send 8 bytes of data. The PC then displays

There is a sharp "knee" in the voltage versus sensitivity curve. From full sensitivity at +12 volts, the supply voltage into the three stages must be re-

Jerry recently obtained a 10-bit shaft encoder and matching Hewlett-Packard interface IC. The output of the HP chip will go directly into the Micromint controller. He says his next software version will support both the analog pot and the shaft encoder.

Congratulations to Jerry and Ed for helping bring T-hunting and computers together. Let's hear what the rest of you are doing.



Ham Television

Bill Brown WB9ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

ATV in Monterey, California

When your ATV group pools resources and equipment, the ability to support public events with an impressive display of visual communications becomes possible.

This month I'd like to feature one such group from Monterey, California. The Monterey portable public service ATV group was started by Doug McKinney KC3RL in 1987. Prior to that time, ATV was primarily a base station activity. Doug came to Monterey from Washington, D.C., where he had developed expertise in portable ATV public service events through the Metrovision ATV Club (featured in Chapter 16 of the *ARRL Operating Manual*).

The following is a description of the Monterey group's recent activities as described by Doug McKinney KC3RL:

Portable Public Service ATV

In 1987, a group comprised of Doug KC3RL, Elliot KB3LY and Don KB6BZL began to use portable ATV equipment at small 5K runs. These small events generated enthusiasm. Within two years, the ATV group had grown to six ATVers supported by extra equipment loaned by the original group of three. Having a supply of extra portable ATV transmitters, antennas, downconverters, coax and masts really helps when covering these public events. One of the benefits is that you have someone else at the other end to receive your picture!

Today we have nine ATV operators with equipment and 11 trained operators without ATV equipment. In addition, we have coordinated with the South Bay Amateur Television Club members to help with events (in particular Don KK6MX and Renie KC6NBS). The Santa Clara Red Cross ATV coordinator, Bob KB6FEC, has been very helpful by loaning us ATV equipment. Bob's equipment loans have also helped a brand-new group in Alameda County, spearheaded by a dynamo ATV public service coordinator, Sue KC6WXXO.

Our public service group has two main purposes: audio and visual communications to help assure public health and safety, and to give operators experience that would enable them to be prepared to assist in the case of a disaster. There are two major events that our group covers that are significantly different in complexity and require what we call the *serial* and *parallel* mode for public service support.

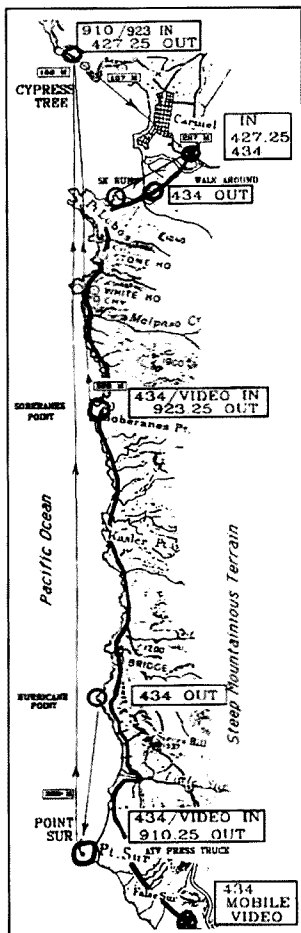


Figure 1. System diagram of the Base Station Control Center for the Hot Air Affair balloon festival.

The Hot Air Affair

The Hot Air Affair is a three-day hot air balloon event held in February at the Laguna Seca Recreation Area and Raceway in Monterey. Laguna Seca is a crater-shaped valley that is 200 feet below the encircling foothill ridge line. This event requires us to use a *parallel* reception path (all transmitters sending to one control site).

In this event we transmit video from the ridge lines into Laguna Seca so the event leaders can see outside of the crater to monitor the sunrise and where the fog is (or isn't). This ensures appropriate start times for safe launches. Once the balloons are launched the event leaders are able to monitor where *all* of the balloons are going and direct chase crews for recovery. Additionally, the event leaders wanted ATV from one of the balloons, providing a unique observation platform for spotting any unexpected

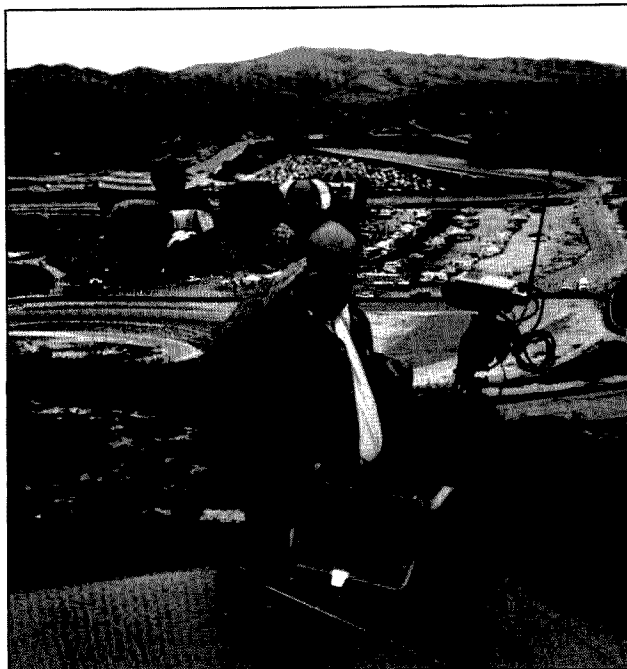


Photo A. Don KC6BZL transmits a bird's-eye view of the hot air balloons back to the launching area from his location on the ridge overlooking the Laguna Seca Recreation Area.

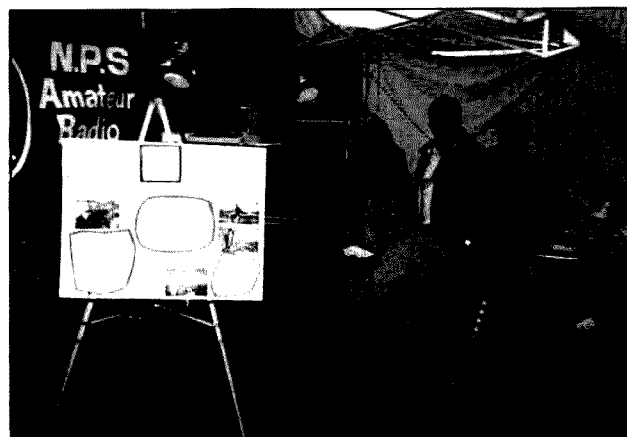


Photo B. Reception from the remote transmission sites is displayed on monitors in the control tent at the hot air balloon launch point. (l to r): Ron KM6DZ, Elliot KB3LY and KC WA6TMK.

problems.

The Hot Air Affair has been 100% successful for the last four years due primarily to performing field tests prior to the event to ensure P5 performance from each site.

The Big Sur International Marathon

This is a one-day event held in April. The runners start at Big Sur and run 26 miles to the north, ending up in Carmel Valley. It's a 26-mile "straight line" run on Pacific Coast Highway 1. If you have ever been on Hwy. 1, you know it's anything but straight! The Pacific Ocean is on one side and a very steep mountain range (2000+ feet) is on the other. This rugged 26-mile section isn't accessible by either

fixed ham repeaters or cellular phones. The *ONLY* communications available for this event are portable ham radio remote bases (2m, 220 and 440) and portable ATV repeaters! The nature of this terrain requires us to use what we call the *serial* mode of ATV transmission (signal A going through repeater B and repeater C to arrive at station D).

Each remote ATV site is completely isolated from outside help. As a result, what you have with you is all that you will have during the event.

We have never been completely successful in getting a picture to the finish line throughout the duration of the Marathon. Any number of factors can result in failure in a serial system

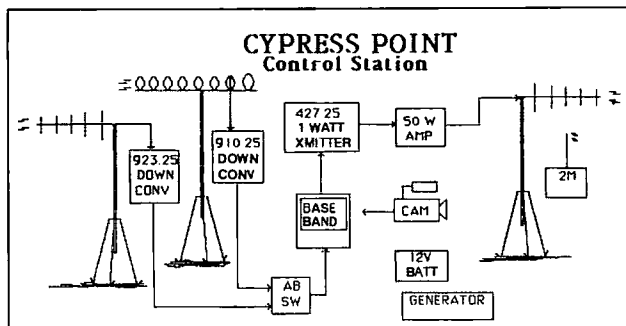


Figure 2. The system used for the 26-mile Big Sur Marathon includes several crossband repeaters at strategic locations along the rugged Pacific Coast Highway 1.

(if just one site goes down, the whole system is out of the picture). In pre-Marathon testing everything worked well, but problems developed during the actual event.

We've listed some of the things we now watch out for (gathered from the School of Hard Knocks) during testing of this kind of system that may be useful for those planning such an event:

- Check all of the equipment and operators in the pre-test.

- Use good coax and standardized connectors.

- Have the ability to do on-site repairs (butane soldering irons come in handy on top of a remote hill).

- Use a power source with proper connectors and an ATV transmitter

PORTABLE ATVERS IN MONTEREY

Operators with equipment:

Doug KC3RL	Don KB6BZL
Allen KC6VJL	Bev KC6AMI
Elliott KB3LY	Pat KA6IRS
Paul KQ6G	Mike WA6EOC
Smitty K6DYX	

Trained operators:

Cal WW7G	Keith WE6R
Charles KN4DG	Judy KD6FYL
Pat AA6EG	Mario KD6ILO
Ron KM6DZ	Rick K6TST
Renei KD6OCP	Charles KC6UXP
Barbara KC6AWM	

adjusted for operation on 12.5-volt battery power (instead of the normal 13.8 volt shack power). The pedestal adjustment on our 910 MHz ATV transmitter seemed particularly sensitive to voltage changes.

- Have a portable TV at each site to monitor your signal (LCD sets work great for this) to verify that your transmitted signal is good.

- Reduce interference by using high-gain antennas before resorting to increasing transmitter power.

- Cross polarize antennas for multiple inband transmitters (about 20 dB or about two P-units reduction in interference is possible).

- For crossband repeaters, use a portable 5" color TV which has video in and out capability (i.e. downconverter into channel 2/3 and baseband video out to the transmitter). This arrangement lets you see the video quality of the received signal.

- Use interdigital (VSB) filters to reduce inband and crossband interference.

Planning for Success

Good planning is absolutely required for success. If your group would like to cover an event, here's some basic elements you should investigate before you start:

- Determine the public service need.
- Develop a detailed plan with the

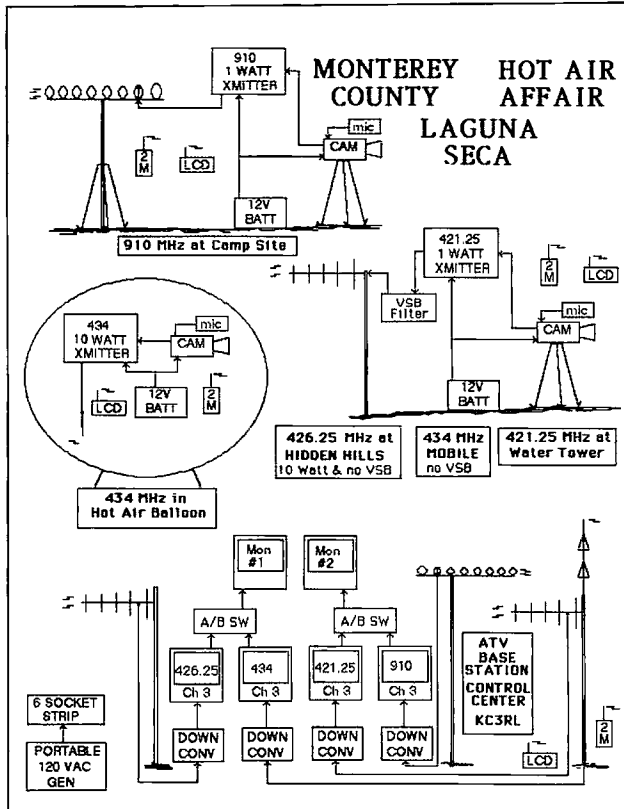


Figure 3. The Cypress Point relay and control station has two 900 MHz band inputs which can be selectively repeated out on 427.25 MHz.

resources available.

- Coordinate with the event leaders to ensure that their needs are met.

- Test the full plan well before the event (see the previous section for problem areas you may encounter).

- Since our early efforts, we have found our limitations and we have found new solutions. Coverage of these events is a great way to get the local ham population involved in ATV and public service. By following these simple guidelines, our group has be-

come proficient in point-to-point and remote base repeater ATV operations.

There is another benefit to our experience in covering public events. In the event of a disaster, our group is ready to provide portable video capability for emergency relief efforts wherever needed. To this end we periodically participate in disaster preparedness drills. It's always great to impress the ARES coordinators with P5 video at the command center during a disaster drill.



Photo C. Bev KC6AMI operates mobile ATV from the press truck during the Big Sur Marathon. Note the small LCD TV she uses to monitor her transmissions.

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Discovering The Discovery Place

When Ervin Jackson N4BIG and Tom Bradbury NU4G first began telling me about their exciting efforts at Discovery Place in Charlotte, North Carolina, I knew that there would be lots of great ideas worth sharing with other teachers and instructors. The Mecklenburg Amateur Radio Society envisioned a place where thousands of visitors, especially youngsters, could be attracted to an exhibit that would educate them in ham radio, electronics, and world geography.

Over 500,000 people a year come to visit the South's largest science and technology museum, and its mammoth new Kelly Space Voyager Planetarium and Charlotte Observer Omnimax Theater. Discovery Place, now the W4FB Amateur Radio Education Center, is part of the museum's new \$14 million Michael J. Smith Wing, which opened last fall. It was named for the North Carolina astronaut who was killed in the horrific space shuttle *Challenger* explosion.

Ervin tells me that the very newest attraction is the addition of TV. This attraction has really excited the student visitors (over 100,000 schoolchildren each year) because they can easily identify with TV. The television input frequency is 439.25 and output is 421.25. If you are a home viewer in the Charlotte area, you can tune into cable channel 60 for the input picture and cable channel 57 for the output picture. The audio input is on 2 meters at 147.45 and the output audio rides on the subcarrier

of the TV channel. The TV repeater is W4PHN.

Both Ervin and Tom speak enthusiastically about how popular Discovery Place is once the school year begins. All the science classes of the Mecklenburg School System attend Discovery Place for lectures that are considered part of their regular curriculum. Until 2:30 p.m. each day one can see school buses coming and going; then there is a lull until the after-school crowd arrives. It seems that everyone goes by the station at least once during a visit to the "hands on" museum.

The station sits behind sliding glass doors between the museum cafeteria and the gift shop, just down the hall from the Omnimax entrance. Station manager Bob Southworth K14YV is a retired electrical engineer who, by all accounts, has a world of patience with the youngsters who line up for on-the-air demonstrations. Two ham radio volunteers are needed to handle the large crowds that come through the exhibit—one of them keeps the QSOs going while the other answers specific questions from the students and visitors. Those who visit the station can see demonstrations of the hobby with a packet station, an all-mode 2 meter rig and an HF setup, complete with a beam atop a 60-foot tower mounted on the roof of the five-story museum addition. There is even an SWL corner where they can tune the shortwave broadcast bands.

The station also has groups who visit with prearranged appointments. These groups are given a 20-minute lecture about amateur radio. Live demonstrations follow, and then a question-and-answer period. Ervin also informs me that they have enjoyed the visits of

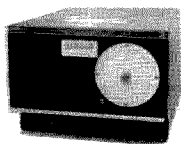


Photo A. David W. Lewis K1CBB pictured with Mrs. Beverly Sanford, a staff coordinator of Discovery Place. This was the museum's first viewing of ham radio TV (ATV)—Discovery Place's newest attraction. Photo by Ervin Jackson, Jr. N4BIG.



Photo B. Members of the Mecklenburg 4-H Club attend a lecture on ham radio at the station. Photo by Ervin Jackson, Jr. N4BIG.

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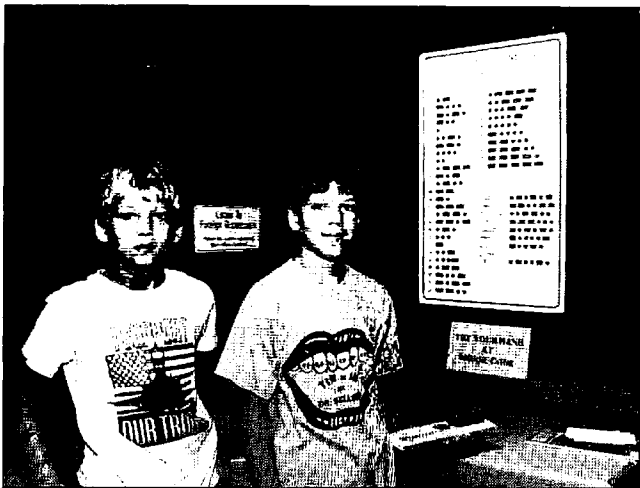


Photo C. Peter Gable and Dana Rucker, members of the Mecklenburg 4-H Club, attend a lecture on ham radio conducted by Bob Southworth K14YV, manager of the W4FBF Discovery Station.

many foreign hams who have talked with the station previously and wanted to see it. Wonderful contacts have developed between other science museum stations, notably Montreal, Canada, and London, England.

Guidelines for a Ham Radio Exhibit

The group has put together an excellent list of suggestions for anyone interested in assembling a ham radio exhibit. I'll list some of the key suggestions, along with a reminder that these ex-

hibits are excellent projects not limited to museums—they can do wonders for your recruiting efforts when properly set up in a mall, at a school, at a convention center, in a church, at a scouting meeting, at a local fair, or anywhere large groups of people, especially youngsters, will be attending.

1. Display of QSL cards from all over the world. This has a high visual impact and conveys the message that we talk to the world. Be sure to include an insert explaining what the informa-

tion on the card means, i.e. RST means readability, signal strength, tone.

2. Frequency spectrum chart. Like the QSL cards, this is visually attractive and requires no personnel. It can show where the ham frequencies are located with respect to radio, TV, police, and fire, etc.

3. Chart showing requirements for a ham license. List the license categories, with a brief description of the requirements for and privileges of each.

4. Handouts. Hand out the many attractive ARRL brochures, along with an ARRL coupon to mail in for more information. Distribute a sheet listing club meetings for all local radio clubs and a list of where the Novice classes are held. A handout with the Morse code and Q signals on it is always a favorite.

5. Comparison chart showing the differences between CB and ham radio. Folks are particularly interested in noting the power and frequency differences. I do this with my own ham radio classes every year, and the children can relate to it since most of them are already familiar with CB.

6. Photo collage showing ham radio activities. Be sure to have lots of pictures of children having fun in various ham radio activities. Include Field Day, hamfests, emergency communications, local parades, satellites, contests, repeaters, traffic handling, antenna installations, etc.

The club also suggests having two booths with a key and buzzer in each, along with a copy of the Morse code, a

ham-band-only receiver behind a protective plastic shield, but extended tuning knob, volume knob, and band switch through the plastic, along with earphones to hear ham radio QSOs.

Other good ideas for the exhibit include: a price list showing station costs, starting with a very modest setup—debunk the notion that it is a very expensive hobby; a world map showing call letter prefixes; a Morse code decoder box to decode received CW signals, or a continuous tape to feed the decoder box at about 5 wpm, and a set of earphones; a small terminal to monitor packet radio activity on 145.01; and an exhibit of old radio gear and new radio gear as a contrast.

Through the outstanding efforts of groups like the ham radio operators who support and maintain the station at the Discovery Place, and other such museum groups throughout the country, hundreds of thousands of children and adults are being exposed to the excitement and diversity of amateur radio. These museum groups are to be commended for their achievements. We as educators and instructors should support their good works and take advantage of what is being offered by bringing classes to these exhibits and by publicizing what they're doing.

For information on operating hours for Discovery Place and the W4FB Amateur Radio Education Center, write to: Discovery Place, 301 N. Tryon Street, Charlotte NC 28202; or call (704) 372-6261.

TNT

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59.2, 59.3, 59.4, 59.5, 59.6, 59.7, 59.8, 59.9, 60.0, 60.1, 60.2, 60.3, 60.4, 60.5, 60.6, 60.7, 60.8, 60.9, 61.0, 61.1, 61.2, 61.3, 61.4, 61.5, 61.6, 61.7, 61.8, 61.9, 62.0, 62.1, 62.2, 62.3, 62.4, 62.5, 62.6, 62.7, 62.8, 62.9, 63.0, 63.1, 63.2, 63.3, 63.4, 63.5, 63.6, 63.7, 63.8, 63.9, 64.0, 64.1, 64.2, 64.3, 64.4, 64.5, 64.6, 64.7, 64.8, 64.9, 65.0, 65.1, 65.2, 65.3, 65.4, 65.5, 65.6, 65.7, 65.8, 65.9, 66.0, 66.1, 66.2, 66.3, 66.4, 66.5, 66.6, 66.7, 66.8, 66.9, 67.0, 67.1, 67.2, 67.3, 67.4, 67.5, 67.6, 67.7, 67.8, 67.9, 68.0, 68.1, 68.2, 68.3, 68.4, 68.5, 68.6, 68.7, 68.8, 68.9, 69.0, 69.1, 69.2, 69.3, 69.4, 69.5, 69.6, 69.7, 69.8, 69.9, 70.0, 70.1, 70.2, 70.3, 70.4, 70.5, 70.6, 70.7, 70.8, 70.9, 71.0, 71.1, 71.2, 71.3, 71.4, 71.5, 71.6, 71.7, 71.8, 71.9, 72.0, 72.1, 72.2, 72.3, 72.4, 72.5, 72.6, 72.7, 72.8, 72.9, 73.0, 73.1, 73.2, 73.3, 73.4, 73.5, 73.6, 73.7, 73.8, 73.9, 74.0, 74.1, 74.2, 74.3, 74.4, 74.5, 74.6, 74.7, 74.8, 74.9, 75.0, 75.1, 75.2, 75.3, 75.4, 75.5, 75.6, 75.7, 75.8, 75.9, 76.0, 76.1, 76.2, 76.3, 76.4, 76.5, 76.6, 76.7, 76.8, 76.9, 77.0, 77.1, 77.2, 77.3, 77.4, 77.5, 77.6, 77.7, 77.8, 77.9, 78.0, 78.1, 78.2, 78.3, 78.4, 78.5, 78.6, 78.7, 78.8, 78.9, 79.0, 79.1, 79.2, 79.3, 79.4, 79.5, 79.6, 79.7, 79.8, 79.9, 80.0, 80.1, 80.2, 80.3, 80.4, 80.5, 80.6, 80.7, 80.8, 80.9, 81.0, 81.1, 81.2, 81.3, 81.4, 81.5, 81.6, 81.7, 81.8, 81.9, 82.0, 82.1, 82.2, 82.3, 82.4, 82.5, 82.6, 82.7, 82.8, 82.9, 83.0, 83.1, 83.2, 83.3, 83.4, 83.5, 83.6, 83.7, 83.8, 83.9, 84.0, 84.1, 84.2, 84.3, 84.4, 84.5, 84.6, 84.7, 84.8, 84.9, 85.0, 85.1, 85.2, 85.3, 85.4, 85.5, 85.6, 85.7, 85.8, 85.9, 86.0, 86.1, 86.2, 86.3, 86.4, 86.5, 86.6, 86.7, 86.8, 86.9, 87.0, 87.1, 87.2, 87.3, 87.4, 87.5, 87.6, 87.7, 87.8, 87.9, 88.0, 88.1, 88.2, 88.3, 88.4, 88.5, 88.6, 88.7, 88.8, 88.9, 89.0, 89.1, 89.2, 89.3, 89.4, 89.5, 89.6, 89.7, 89.8, 89.9, 90.0, 90.1, 90.2, 90.3, 90.4, 90.5, 90.6, 90.7, 90.8, 90.9, 91.0, 91.1, 91.2, 91.3, 91.4, 91.5, 91.6, 91.7, 91.8, 91.9, 92.0, 92.1, 92.2, 92.3, 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136.3, 136.4, 136.5, 136.6, 136.7, 136.8, 136.9, 137.0, 137.1, 137.2, 137.3, 137.4, 137.5, 137.6, 137.7, 137.8, 137.9, 138.0, 138.1, 138.2, 138.3, 138.4, 138.5, 138.6, 138.7, 138.8, 138.9, 139.0, 139.1, 139.2, 139.3, 139.4, 139.5, 139.6, 139.7, 139.8, 139.9, 140.0, 140.1, 140.2, 140.3, 140.4, 140.5, 140.6, 140.7, 140.8, 140.9, 141.0, 141.1, 141.2, 141.3, 141.4, 141.5, 141.6, 141.7, 141.8, 141.9, 142.0, 142.1, 142.2, 142.3, 142.4, 142.5, 142.6, 142.7, 142.8, 142.9, 143.0, 143.1, 143.2, 143.3, 143.4, 143.5, 143.6, 143.7, 143.8, 143.9, 144.0, 144.1, 144.2, 144.3, 144.4, 144.5, 144.6, 144.7, 144.8, 144.9, 145.0, 145.1, 145.2, 145.3, 145.4, 145.5, 145.6, 145.7, 145.8, 145.9, 146.0, 146.1, 146.2, 146.3, 146.4, 146.5, 146.6, 146.7, 146.8, 146.9, 147.0, 147.1, 147.2, 147.3, 147.4, 147.5, 147.6, 147.7, 147.8, 147.9, 148.0, 148.1, 148.2, 148.3, 148.4, 148.5, 148.6, 148.7, 148.8, 148.9, 149.0, 149.1, 149.2, 149.3, 149.4, 149.5, 149.6, 149.7, 149.8, 149.9, 150.0, 150.1, 150.2, 150.3, 150.4, 150.5, 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164.9, 165.0, 165.1, 165.2, 165.3, 165.4, 165.5, 165.6, 165.7, 165.8, 165.9, 166.0, 166.1, 166.2, 166.3, 166.4, 166.5, 166.6, 166.7, 166.8, 166.9, 167.0, 167.1, 167.2, 167.3, 167.4, 167.5, 167.6, 167.7, 167.8, 167.9, 168.0, 168.1, 168.2, 168.3, 168.4, 168.5, 168.6, 168.7, 168.8, 168.9, 169.0, 169.1, 169.2, 169.3, 169.4, 169.5, 169.6, 169.7, 169.8, 169.9, 170.0, 170.1, 170.2, 170.3, 170.4, 170.5, 170.6, 170.7, 170.8, 170.9, 171.0, 171.1, 171.2, 171.3, 171.4, 171.5, 171.6, 171.7, 171.8, 171.9, 172.0, 172.1, 172.2, 172.3, 172.4, 172.5, 172.6, 172.7, 172.8, 172.9, 173.0, 173.1, 173.2, 173.3, 173.4, 173.5, 173.6, 173.7, 173.8, 173.9, 174.0, 174.1, 174.2, 174.3, 174.4, 174.5, 174.6, 174.7, 174.8, 174.9, 175.0, 175.1, 175.2, 175.3, 175.4, 175.5, 175.6, 175.7, 175.8, 175.9, 176.0,

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Power MOSFETs

The schematic shown in Figure 1 shows how a power MOSFET is configured as a high-side switch. Also, note the difference between the "P" channel device and an "N" channel device. The use of a "P" channel power MOSFET allows the designer to cut the number of discrete components because a charge pump circuit will not be required. On the other hand, the use of a "P" channel power MOSFET,

with its higher $R_{DS(on)}$, will generate more heat and thus diminish operating efficiency. It then becomes a trade-off in the number of extra parts needed for the gate driver (voltage pump) or the loss of efficiency with the "P" channel device. Even the best "P" channel power MOSFET on the market has a rather high $R_{DS(on)}$ of an ohm or two.

You can use the power MOSFET as a simple switch. I have used them to replace a switching transistor in some projects. A common example is to use a transistor switch to operate a relay for T/R control. As shown in Figure 2, a power MOSFET will work

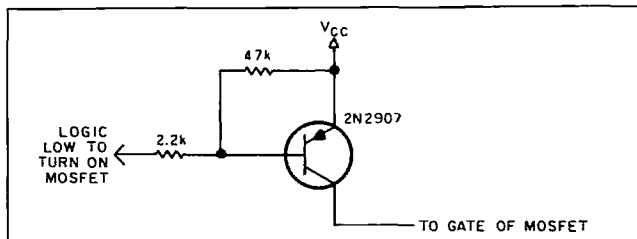


Figure 3. Using a transistor switch to supply the gate drive.

quite nicely in this configuration. The only requirements will be the proper gate voltage and, of course, the amount of current the relay will draw. This is normally not a problem with a power MOSFET; a drain current of several amps is common.

The power MOSFET is turned on by applying +10 volts to the gate. This requirement is easily handled by using a CMOS gate since the output of the CMOS gate is usually over 10 volts when operating with a 12-volt VCC line. Depending on the MOSFET, gate capacitance may cause some distortion when rapidly switching the MOSFET. In the case of our T/R relay, the distortion will never be noticed. Capacitance of several pF to several thousand pF is common, depending on die size. In some cases, paralleling CMOS gates together will help overcome the difficulty in driving the power MOSFET directly from a CMOS IC.

With the extra gate capacitance, the turn-off time may be too long. A transistor switch may be added to reduce the on time after the gate drive has been removed.

Using TTL logic will increase the drive current, but the normal VCC of TTL logic, just +5 volts, will not drive

the power MOSFET fully on. In this case, a transistor switch may be employed to supply the gate drive. Such a circuit is shown in Figure 3. Notice the use of a PNP transistor. When the base of the transistor is pulled low, the transistor is turned on and voltage appears on the collector. This voltage then turns on the power MOSFET. Again, this circuit will work up to several kHz before the switching distortion becomes troublesome.

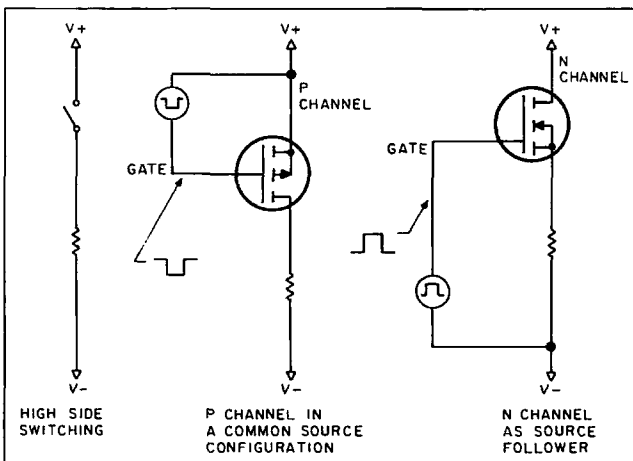


Figure 1. The power MOSFET configured as a high-side switch.

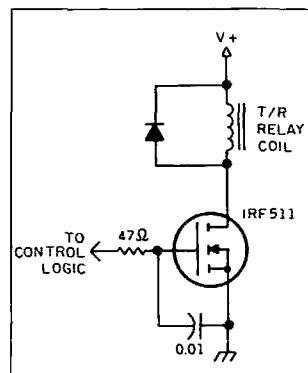


Figure 2. Using a power MOSFET to operate a relay for T/R control.

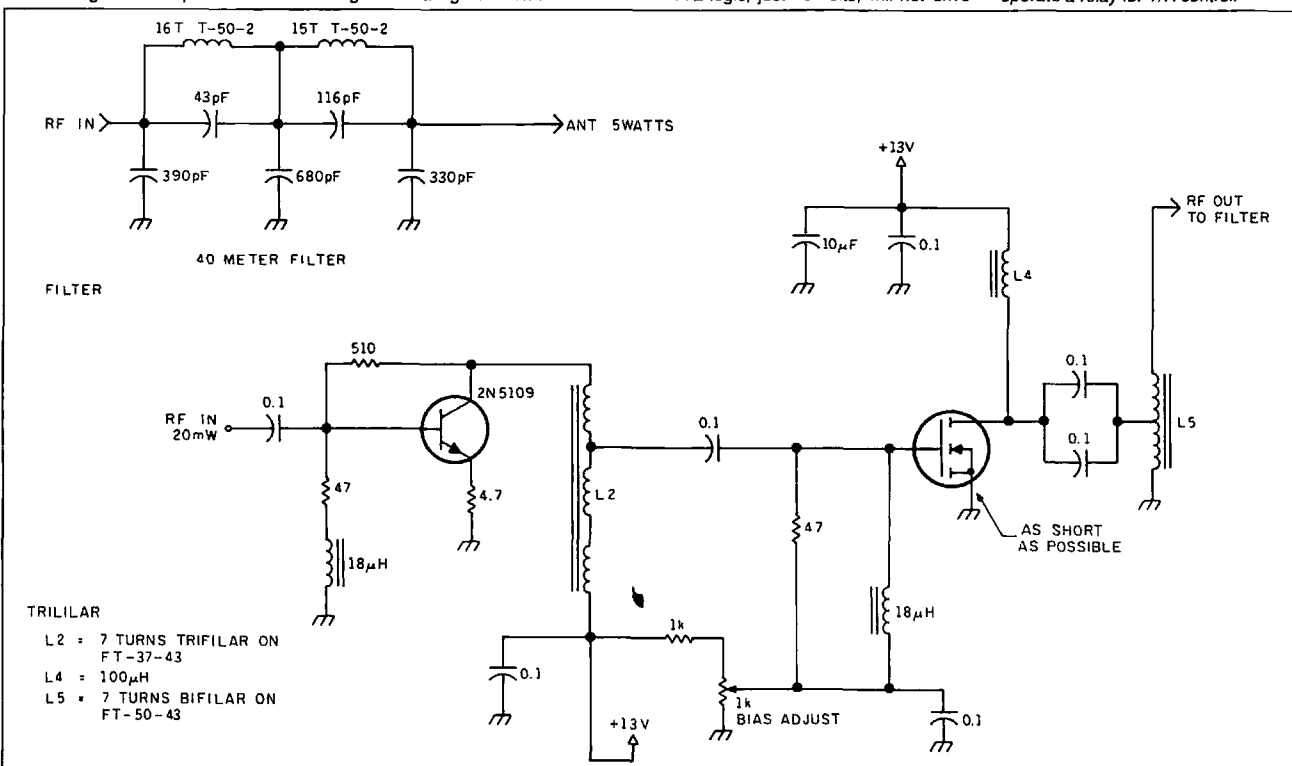


Figure 4. An RF amplifier using a single transistor and a power MOSFET.

RF Amplifier Circuit

Only now are we seeing designs using power MOSFETs in RF applications. Figure 4 is a simple RF amplifier using a single transistor and a power MOSFET. I did not design the circuit—credit for it goes to Bruce Franklin KG7CR. The circuit originally came from the Northwest QRP club newsletter, June 1992. Bruce kindly gave me permission to present it here to you. I have not had the time to build the circuit myself, therefore I can't comment on its performance. Bruce says the circuit will produce 5 watts of RF with only 20 milliwatts of drive. Bruce's original schematic contained some fancy band-switching features using reed relays and a 4015 IC. This schematic shows only the driver and the MOSFET PA components, along with one section of the output filters. The output filter values are for the 40 meter band.

You can use the amplifier for SSB, too! All you have to do is set the bias to about 50 mA with no drive. If you're a CW-only person, then a much lower bias will do. Bias is set by R5, the 1k trimmer.

Suitable sources of RF drive may be VFO, VXO or even the output of a mixer such as the NE602. In the case of the VFO, an extra stage of buffering may be needed if you notice pulling of the VFO frequency.

Also notice that the VCC for the amplifier is only +12 volts. It would be

possible to get better efficiency at a higher voltage, but then you would need to re-compute the values of the LC networks. Of course, you would have to split the circuit in half as the +28 volts would be too much for the bipolar transistor used as a driver.

Bruce uses the IRF510. The IRF511 is available from Radio Shack for under \$2. If you can't find it, an IRF531 would be a good substitute to try.

A very good application of a power MOSFET used as an RF amplifier is described in the November 1990 issue of *73 Amateur Radio Today*, page 36: "The MOuSe-FeET," by Bill Heishman N5HNN. I had the good fortune to work on this amplifier and can say that it works first-class all the way.

As shown in the original article, the filter values are for the 40 meter band. The values for the 20 meter band are as follows:

L1	6T x 1/2
L2	3T x 1/4
L3	9T x 1/2
L8	6.8 µH
C1	1000 pF
C2	Not used
C3	1360 pF (2 x 680 pF or 2 x 500 + 270 pF)
C4	250 pF

All coils are 20-gauge copper magnet wire air wound on 3/8" form and spread to proper length.

With my HW-8 on 40 meters and running both the amplifier and the

HW-8 on a 12.6 volt supply, I had 20+ watts (my QRP wattmeter only goes to 20 watts and the needle was pegged) going into the dummy load. I know had I increased the supply voltage to 13.8 volts, my output power would have been close to 30+ watts. The heat sink became rather warm with the 20 watts and more than likely a larger hunk of aluminum is necessary at higher power. My aluminum heat sink measured the same size as the PC board and was 1/8" thick. The relay-less QSK keying is a real pleasure to use, too. If someone really wanted to, a band-switching model could be constructed to give multiband performance. Operation on 10 meters may result in slightly lower output as noted in the original text. Circuit boards for the amplifier are available from Far Circuits, 18N640 Field Court, Dundee IL 60118.

Toroids and the Wattmeter

Several months ago when discussing the directional wattmeter, I mentioned the cores used as being "special." That's true and I still

don't know what kind of material is used for the core. I mentioned I'd try a T-50-6 core as a start. Several readers wrote to tell me that's the wrong type of material for use in this type of project. I mentioned the T-50-6 core primarily because the ones used in the project are yellow, just as a T-50-6 core is. Hold up a T-50-6 core beside the one in the wattmeter and you'll have a hell of a time trying to tell the difference. That is why I made the suggestion. The core should be of ferrite material instead of the powdered iron material used in the T-50-6 core.

73

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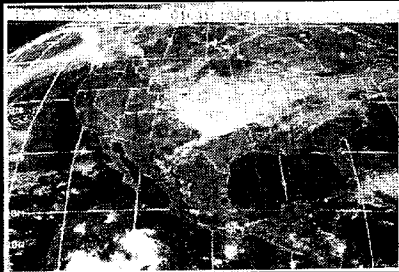
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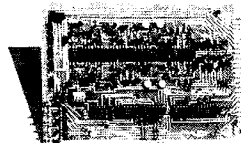
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February may mean many things to many people, but here in Baltimore, February is the most common time for the "big snow" to hit. Presuming that many of you may find yourself in that situation this time of year, I thought it might be a good

Amateur Radio Teletype

time to pull out that old mechanical teletypewriter and try to get it on the air.

Thanks to Dave Gearhart WA4GVT of Huntingtown, Maryland, I am in receipt of some basic information needed to get these machines running.

Figure 1 is a drawing of a Model 28 cabinet, showing the location of the various cables and terminal strips which

need to be accessed. The "C" terminal strip, which contains all the vital connections, runs across the back of the machine. As detailed in Figure 2, the cable connects to the top of the strip, with the permanent wiring coming in on the bottom of the strip.

Figure 3 shows a schematic diagram of the Model 28-RO (receive only) wiring, and should be helpful to anyone trying to resurrect an old machine.

Another popular machine is the Model 33-ASR, commonly used on computer circuits. This ASCII machine with Automatic Send and Receive capability (ASR)

can frequently be obtained from old computer mainframe sites, and can be used as a hard copy teleprinter, particularly when connected to an interface which accomplishes the ASCII-to-Baudot translation. Figure 4 is a similar schematic of wiring for this machine.

All in all, I hope this information is a useful addition to the attempts to get that old greasy piece of hardware on the air.

To get that computer on the air, don't forget the RTTY Loop software collection. At this time, there are three sets of programs available. Set One is the "original" RTTY Loop program disk, containing an assortment of RTTY and ham radio programs, containing the programs needed to deal with all of the commonly used archives, along with DOS and Windows shells. The newest collection, Set Three, has even more RTTY and ham programs. Each collection is about one megabyte of stuff, and will fill a 5-inch 1.2 Mb or 3.5-inch 1.44 Mb disk. If you send me 360 kb

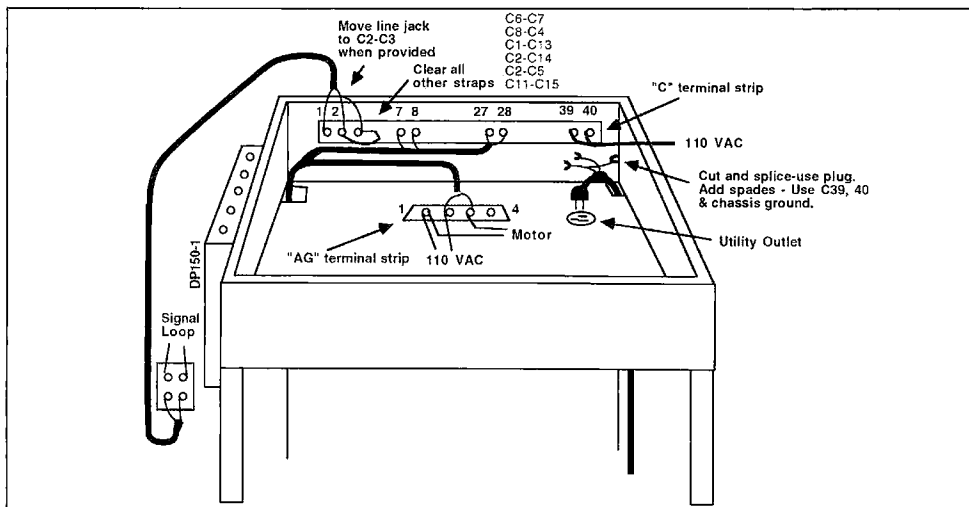


Figure 1. Model 28-RO cabinet wiring.

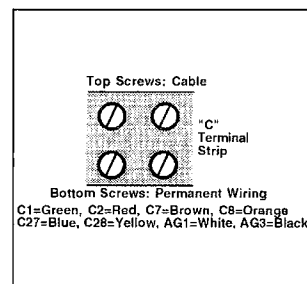


Figure 2. Model 28-RO cable routine details.

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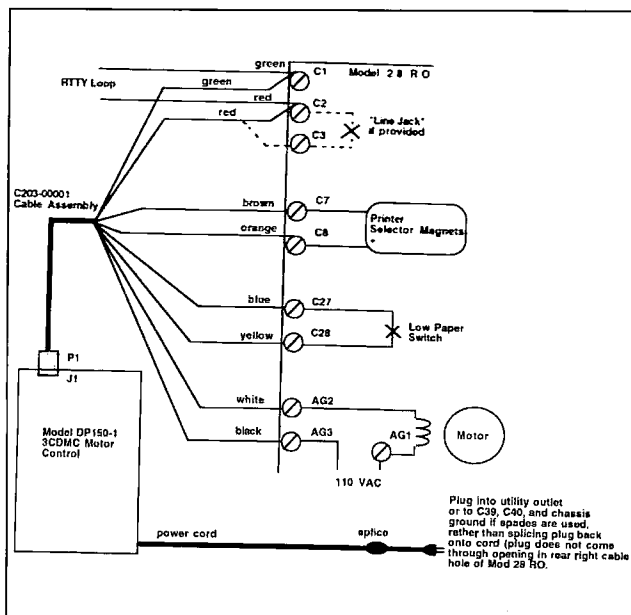


Figure 3. Final wiring of Model 28-RO teleprinter.

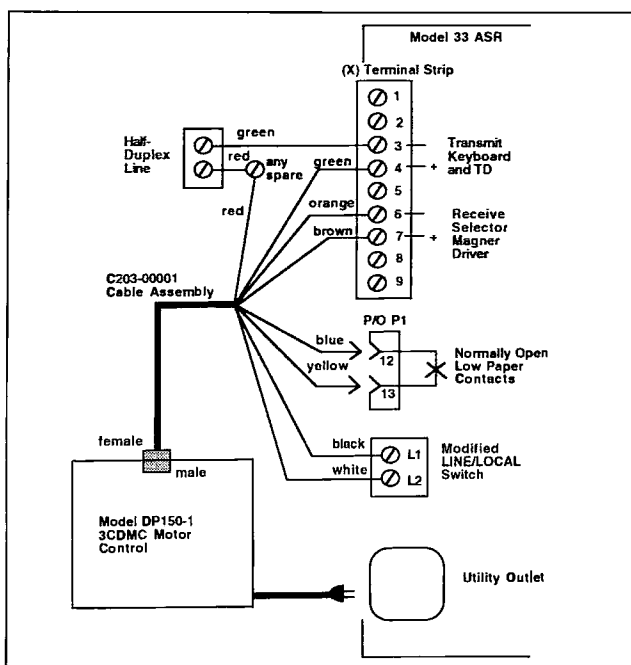


Figure 4. Final wiring of Model 33-ASR.

or 720 kb disks, it will take correspondingly more disks, typically four of the former or two of the latter, per set. To obtain any or all of this stuff, you must send: a note telling me which set you want (I am not clairvoyant); sufficient media (5" or 3.5", low or high density, no need to format the disks) to hold the data; a self-addressed, stamped disk mailer to return the media to you; and \$2 in US funds per

disk. Send all this to me at the above address and I'll do my best to turn it around in a few days.

Glen Johnson WB2MPK of West Orange, New Jersey, wins the prize for being the first to correct me on a typo from the December column. I stated that the ARC program was originally developed by a company called "Software Engineering Associates," and Glen was quick to

point out that the correct name of the company is "System Enhancement Associates." Well, at least I got the initials right! I only hope the program's author, Thom Henderson, is not upset at me.

Meanwhile, I look forward to your cards, notes, questions and comments. As always, you can reach me electroni-

cally, as many of you have, on CompuServe (ppn 75036,2501), on Delphi (username MarcWA3AJR), or on America Online (screen name MarcWA3AJR). I look forward to hearing what you want to know, and what you think. Who knows, you might see your topic become the next focus of "RTTY Loop!"

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Techno-Whizzy 1, Parts 1 & 2

Refer to the above article in the December 1992 issue, page 12. Diode D1 is backwards in the schematic diagram (Figure 3), it should be installed as shown in Figure 1 below. Note that the diode position is shown correctly in the parts placement diagram in Figure 4b. *TNX to Jean-Claude Abrazit for the correction.*

The Basic program to determine the diode placement for a given frequency has a typo in line 9000 ("0101" was entered twice instead of "0110").

It should read: 9000 DATA "0000","0001","0010","0011","0100","0101","0110","0111". As a result, the values shown in the accompanying sidebar entitled "Some Common QRP Frequencies for the TW-1" are in error and should be recalculated with the updated Basic program. *TNX to Jean-Claude Abrazit for the correction.*

In the January 1993 issue on page 14, the wire size was omitted for the output filter toroid windings (Table 1). It's best to use #26 enameled magnet wire.

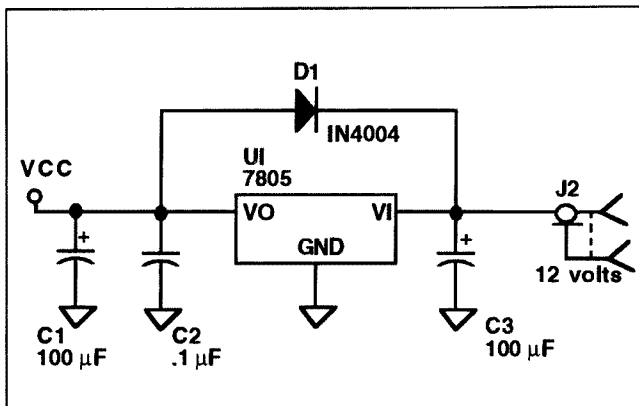
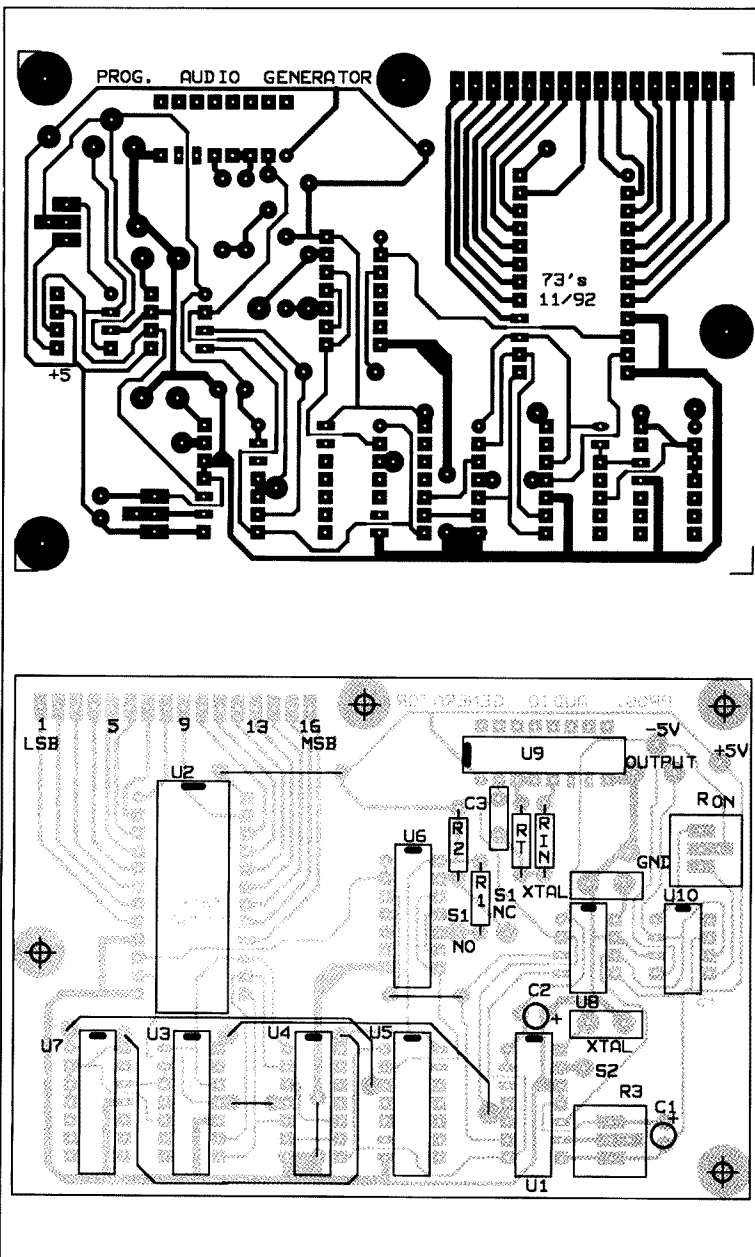


Figure 1. The corrected schematic of the Techno-Whizzy 1 voltage regulator circuit, showing the proper placement of diode D1. Refer to Figure 3 in the December 1992 issue.



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9600 Baud Backbone— Lone Star Style

What do residents of Texas, Oklahoma, Colorado, Indiana, and Michigan have in common? Well, among some other possible answers, they've got a 9600 baud packet backbone called TexNet. Though the regional systems aren't linked, the Indiana-Michigan system (called GLNET, for Great Lakes Network), Oklahoma and Colorado systems use the hardware and software designed in Texas as a high-speed route for BBS forwarding and user traffic.

TexNet began in 1985 as a summer project for Texans Tom McDermott N5EG and Tom Aschenbrenner WB5PUC. The idea was to create a low-cost, high-speed backbone for packet radio traffic. By the October of '86 the system was operational, and Texas hams now have connections among eight cities, with more on the way. This expansion is thanks to the coordination effort by TPRS (the Texas Packet Radio Society), the organization championing TexNet. Unlike high-speed backbones dedicated to BBS traffic forwarding, TexNet was designed from the start to provide services to the end user, and to allow message forwarding.

Multi-Talented

In addition to the 9600 baud backbone connection, each TexNet node provides a primary and secondary user port designed to communicate with the LAN (Local Area Network) where it is located. The usual case is 1200 baud AX.25 ("normal" packet), but other protocols can be supported. This makes direct access to the high-speed backbone readily available to users for connections to remote stations in range—direct or via digis—of a TexNet node. The system makes long distance keyboard-to-keyboard QSO operations not only possible but fun.

If that isn't enough, how about adding local digipeater service, a mailbox, and a pair of conference bridges for round-table nets? Looking at everything a TexNet node provides, TPRS's description of one as a "multi-resource" is fitting.

The Hardware

The heart of a TexNet node is a TPRS NCP (Node Control Processor) board. This board has connections for a pair of radio modems, also available from TPRS. One of the things that makes a TexNet node inexpensive to implement is the choice of RCA 700 radios for the 9600 baud side. These are land mobile service, mobile radios which can often be found surplus at a low price. They are easily tuned into the ham bands, and are very rugged. Any appropriate radio can be

used on the 1200 baud side. The low cost and simple nature of the hardware makes TexNet an attractive option for areas wanting to build a backbone.

GLNET

So attractive, in fact, that when a first effort at a Northern Indiana-Southern Michigan backbone on 6 meters fizzled in 1989, the Michigan sysops latched onto TexNet's already integrated design as the answer. Over the next year, things started to happen in Indiana, too. Today, GLNET will get you keyboard-to-keyboard from as far south as Franklin, Indiana, using the Indianapolis node (atop the State Office Building) to Mount Pleasant, Michigan, north of Grand Rapids (more than 300 air miles). TexNet nodes are easily interfaced with the more common networking schemes, such as TheNet and KaNodes. This means that the usable coverage of the GLNET system is extended from each node by these other systems.

A TexNet network is also a great way to provide special data services to end users. The GLNET system offers a centralized mailbox, a weather server, and—thanks to N8IMO in Grand Rapids, Michigan—an Internet gateway. For those not familiar, the Internet is an enormous network of government, educational, and commercial computers all over the world. It is a patchwork of technology, with everything from high-speed (56 Kilobits per second and up) backbone segments, to 1200 baud dial-up connections keeping the data moving. The Internet uses a protocol called TCP/IP for Transport Control

Protocol/Internet Protocol. This is often referred to as simply "IP." IP has some advantages over the AX.25 (Amateur X.25) protocol typically found on packet radio networks, and most TNCs can be made to run IP directly; however, it is not an easy thing to get going. There are many pitfalls in getting TCP/IP running; if you are interested, find an IP Elmer.

Hams use the Internet through what are called "wormholes." An Internet wormhole is accomplished by a technique called encapsulation, where a TCP/IP packet is wrapped in another TCP/IP packet. Why is this necessary? Because on each end of a wormhole are radios, and the users of those radios must be licensed. Encapsulation ensures this by hiding the actual destination, preventing users who did not start from an amateur connection from getting into a place where their data could end up on the air.

The N8IMO TCP/IP mailbox offers AX.25 users a way to connect to the wealth of resources available on the Internet. In addition to being a full service PBBS itself, N8IMO offers users telnet services. Telnet is an IP utility that allows users to log onto remote computer systems—the same way you would if you were to dial up. The difference in this case is that it is accomplished across the Internet, not phone lines. With telnet, an Internet connected user can hop all over the globe. N8IMO, for example, offers connections to the University of Michigan, where there is both a weather server—provided by Zephyr of Massachusetts—offering all of the NWS (National Weather

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With Internet telnet, connections to nearly anywhere is possible—Australia, the Netherlands, Canada, all over the US—just about anywhere there is a ham and a university. Personally, I find it amazing to have fast, reliable communications with amateurs in Australia, completely independent of propagation conditions. Some may argue, "It uses land lines—it's not ham radio." Perhaps it is not DX, and QSL cards for the contacts wouldn't be very meaningful, but this sort of reliable, routine communications—previously available only to local or regional repeater systems—lifts ham radio up to a new level, in my opinion.

Easy to Use

The TextNet software is very simple on the user side. It has a minimal command set that is easy to remember. If it has a shortcoming, it is cryptic error messages—which are often only indicated with a number. Without a list, you're lost. Figure 1 shows a typical session with the Indianapolis GLNET node (Indy). You can see that the first step is to connect—via normal AX.25—to the node itself. TextNet convention has the node using the SSID (Secondary Station ID) of 4, so I could have connected to WA9ZCE-4. Instead I used the nodes alias. Once connected I am presented with the Network CMD? prompt, which indicates that the node is

ready for my commands. Typing "?" at this point would get me a brief list of commands. I knew that I wanted to connect to the NBIMO gateway, so I entered "c grip @ ngrapid."

"C" is for connect, just like you are used to on your TNC. "GRIP" is NBIMO's GLNET alias—for Grand Rapids IP. The "@" indicates that what follows is a GLNET node. The same method can be used to connect to any station in range of a GLNET node. For example, to connect to my station, a user could type:

c nlewo @ indy

Or, if I wasn't able to connect to the Indianapolis node directly, up to two digis (digipeater) could be included:

c nlewo v eocmbx @ indy

Here the connection would be made via eocmbx—the alias for the Johnson County, Indiana, RACES PBBS. Other simple TextNet commands are:

C CQ@ (node)—sends a CQ message from the specified node.

B—disconnects.

L—lists the locations of all known nodes.

M—connects to the designated message server (mailbox).

M@ (node)—connects to a specific message server.

S@ (node)—displays various connection statistics for a node.

S Y@ (node)—yesterday's stats.

As you can see, TextNet is pretty easy to use. Its designers intended it to be used by the general packet community and so made an effort to make it easy. This easy-to-get-along-with orientation

```
c indy
*** CONNECTED to INDY [12/04/92 06:16:05]

WA9ZCE-0 at INDY Virtual connection 03 at 06:16:09 on 12/04/92
*** Welcome to GLNET v1.60 Copyright 1990 TPRS ***
Network CMD ?
c grip @ ngrapid

Your connection is established
[JNOS-1.07-H5]

Welcome wa9ure,
to the NBIMO TCP/IP Mailbox (911229 [WG7J v1.07-beta release 5 /
NBIMO])
Currently 1 user(s)
Type:
H for Help use!
? for command list
A for mail Areas
A NAME to change mail Area (ex A ALLMI)
LA to List All msgs at current Area
WX for WEATHER SERVER
C for CONVERSE BRIDGE
D SITES for resource list

New mail in: AMSAT HELP KEPS MICHNET NOS-BBS SKYWARN
SPACE SPACENEW TCPGROUP
Area: wa9ure Current msg# 0.
?, A, B, C, D, E, F, H, I, IH, IP, J, K, L, M, ML, MS, N, NR, O, P, R, S, T, U, V, W, WX, X, Z
>
Oh, a GLNET user - Switching callsign to: nlewo.
Area: nlewo Current msg# 0.
?, A, B, C, D, E, F, H, I, IH, IP, J, K, L, M, ML, MS, N, NR, O, P, R, S, T, U, V, W, WX, X, Z
>
```

Figure 1 shows a typical GLNET session with the Indianapolis node. In this case, I connected to the NBIMO Internet gateway, whose alias is GRIP. NBIMO's software has been modified to recognize a GLNET connect and to adjust the callsign appropriately. See the text for more.

has also made its integration into existing networking schemes especially easy.

How Can You Get Involved?

If you are in the service area of GLNET (Indiana, Michigan, and surrounding states), try contacting IDEA (the Indiana Digital Experimenters Association) for information on supporting or expanding GLNET (more good node locations are al-

ways welcome).

For membership information, contact: IDEA, Les Catlin KD9LP, 219 Woodland Hills, Peru IN 46970. If you are in the TextNet service area, or would like information/equipment to start your own TextNet backbone, contact: TPRS, P.O. Box 50238, Denton TX 76206-0238.

Special thanks to Tom Frisz N9DD for information on GLNET. 73 de N1EWO.

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What's New?

Lots of new things have been happening in radio technology. Let's take a break from the repair theme this month and look at some of the new developments and how they affect us.

Digital

Aren't you sick of that word? It seems like you just can't get away from it! Is there anything made today that isn't digital? Well, the basic guts of receivers and transmitters are still analog, but with digital control. That, however, is slowly changing as advances in IC manufacture make possible very-high-speed chips. These new silicon products are opening up all kinds of exciting possibilities. Let's look at a few.

DSP

Digital Signal Processing is going to change our radios, and it will be a very positive change. Already there is a product being marketed to hams which can improve HF SSB quality to something approaching the wired telephone. I

haven't actually tried it, but I suspect it works pretty well because it is an offshoot of a military product. The basic idea is to put a low-frequency pilot tone in with the audio on transmit. Also, the transmitted speech is processed to permit maximum intelligibility. The real trick, though, happens during receive. The unit at the receiving end detects the pilot tone and analyzes it to determine how it has been affected during its trip. Then, a digital signal processing chip compensates for the various kinds of degradation. That, along with dynamic expansion to undo the transmitter's speech compression, goes a long way toward restoring the original voice quality. Finally, new DSP techniques permit real-time analysis of the speech signal to remove noise and static. The result is that most of the garbage is removed, making the processed signal sound tremendously better than regular old SSB. And, it doesn't require one extra Hz of bandwidth to do it.

There are some trade-offs, of course. First, the inclusion of the pilot tone means that some transmitter power is being "wasted" on something other than your voice. In a way, it's kind of like having a carrier, except that it is much weaker than a regular AM carrier would

be, so the amount of waste is much smaller. In the long run, of course, the signal-to-noise gain of the system far outweighs the amount of lost power. Second, both radios need to have the devices for the scheme to work. I expect that eventually there will be an accepted set of standards for this kind of processing, allowing the system to be built into new rigs. I certainly hope that comes to pass.

Some receive-only DSP noise filters are already available. These range from notch filters which can remove multiple heterodynes to noise filters which can separate speech from static and adjacent-channel "monkey chatter." As prices drop, they'll get more popular.

Fast Modems

DSP is allowing the creation of some really fast modems. It is now common to send 14.4 kilobits per second over standard 5-kHz telephone lines. For that matter, compressed-format moving video is being sent along with digitized voice on the same lines. I wonder how long it will be before we send digitized voice over our allotted 3-kHz bandwidths. Hey, I wonder if anybody has managed to send the AT&T videophone's signal over the radio. I suspect it may use a synchronous modem system, which would make that impossible, except perhaps on VHF or UHF full-duplex links. Has anybody messed with it?

True Digital Radio

The ultimate use for DSP would be

to make the entire radio digital. Incoming signals would be digitized at the antenna, perhaps after one stage of amplification. Tuning, filtering and detection would be accomplished through digital signal analysis. The resulting bit stream would pass through a digital-to-analog (D/A) converter. An amplifier and speaker would be all that would be left! Imagine a multimode receiver with digital tuning, variable passband, memories, the whole works, that you could wear on your wrist. It's going to take awhile, but it will happen. I suppose you couldn't wear much of a transmitter because of the power requirements, but the same DSP technology can and will be used in full-sized transmitters. The only analog parts will be the RF power amplifiers.

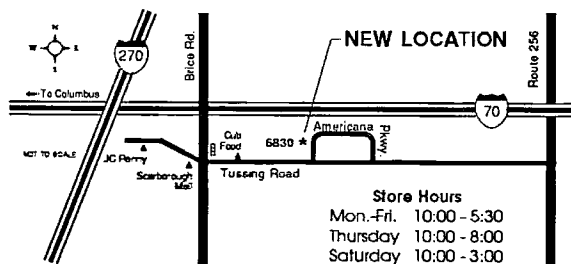
DDS

Direct Digital Synthesis is a new technique for generating local oscillator frequencies. Until now, frequency synthesizers have suffered from some wobble and jitter (called "phase noise"). This aberration causes various symptoms, the most annoying one being muddy, hissy receive audio and an apparent widening of the receive passband. Although synthesizers have improved quite a bit over the early designs, the problem couldn't be completely solved because it is inherent in the design; as long as an analog oscillator must be kept on frequency through constant correction, it will wobble around its center frequency. Now, there's another way.

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no analog oscillator. Instead, sine waves are built up as a series of digital steps and then low-pass-filtered into clean, jitter-free waves. It might seem that the step-like nature of the sine waves would make them rather distorted, but that just isn't the case. If enough steps are used, the distortion frequency will be much higher than that of the sine wave itself, and it becomes fairly easy to filter the junk out. The filtering leaves lovely, smooth waves. Exactly the same technique is used to reconstruct the music signal in CD players, and you know how great they sound!

So why haven't we been doing it that way all along? Well, in order to have plenty of steps, the chip must operate at many times the speed of the signal we want to create. For music, that's not too hard because we don't need a signal over about 20 kHz anyway. But, when we want to generate signals in the multi-megahertz range, it's another story. Until recently, the D/A converters and related circuits just weren't fast enough. Heck, 10 years ago the average desktop PC ran at between 1 and 5 MHz. Now, 50 MHz computers are common, and even faster ones are coming soon.

The advantages of DDS over previous synthesizer designs are very reduced phase noise (in other words, spectral purity), ability to settle to a new frequency quickly (great for spread spectrum and split CW), and smaller tuning steps. Some DDS rigs can tune in 1-Hz increments! Do we need such precision? It sure doesn't hurt. It seems

like overkill now, but it may become important later on as synchronous signal processing schemes are devised. Those schemes may require that the transmitter and receiver be on precisely the same frequency. Of course, the master reference oscillators driving those synthesizers will have to be improved in order to back all that precision with equivalent accuracy. It's not of much use to be tuned to within 1 Hz if it ain't the right 1 Hz!

There's one other advantage of DDS: simplicity. Without all the analog parts, a DDS can be reduced to a few chips. The insides of those chips may be complex, but the resulting circuits can be quite simple. Are there any disadvantages? Just one that I can think of: cost. Right now, high-performance DDS parts are expensive enough that traditional synthesizer designs are still competitive. That's changing, as it always does, and I expect DDS to completely take over in the next few years. Today's non-DDS rigs will soon seem nearly as antiquated as all-analog rigs do now.

Power, Please

The weakest link in modern electronics still is power. Sure, there's no problem if you're near an AC outlet, but batteries are positively primitive. Nickel-cadmium batteries are an old technology that never worked all that well unless the cells were used under carefully controlled conditions. If you've owned your walkie for more than a year or two, you

know what I'm talking about.

That's changing too. New nickel-metal-hydrate batteries are coming. They have about twice the energy of NiCds, and there's less "memory" problem as well. They're rumored to be coming to ham radio and camcorder applications soon. I'll let you know more as I learn it.

There haven't been any recent breakthroughs in power supplies, but switching supplies are evolving and getting quieter. The old ones made an awful lot of RF noise, which limited their radio applications. Better shielding and design are resulting in cleaner supplies, and I expect them to start showing up more and more in HF rigs. Their primary advantages are size and weight; they can be dramatically smaller than linear supplies of equivalent power output. Historically, switchers have had reliability problems, but those have been pretty well solved, due to the popularity of desktop computers, all of which use switchers. In fact, the little wall cube which powers my laptop is actually a miniature switcher, as is the small supply for my camcorder. I look forward to seven-pound, 100-watt HF rigs with built-in AC supplies. With today's surface-mount technology, it should be possible to make an HF rig the size of a large 2 meter mobile rig. Sounds good to me.

Let's look at a letter:

Dear Kaboom,

My Alinco model 110 2 meter rig has an odd problem. In the low power posi-

tion, it works fine. In the high power position, however, the transmitter draws more than 25 amps for a moment and then it drops to zero, with no RF output. It seems to be clamping itself off, but I don't know why. Any ideas?

Signed,
On-Off

Dear On,

25 amps?? Yikes, at 13.8 volts that's 345 watts! Something's breaking down here. I agree that it's shutting off because the clamp circuit is working, but the question is, what's causing that huge current drain in the first place? I suspect the final output transistor. It may work fine at lower power and break down when full power is applied to it. Or, it could be a capacitor or other part in the output filter, or even a bad connection. More than likely, though, it's the silicon. If the transistor is discrete, you can try changing it. Of course, that will force you to do all kinds of adjustments, some of which may require specialized equipment. If it's a module, the whole module will have to go. Because this problem is so hard to determine, though, I'd send it off to Alinco and let them do it. After all, it sure wouldn't feel too good to shell out for a new output module and then discover that the real problem was something like a bad capacitor or antenna connector. Hey, here's a thought: Are you sure your antenna or coax isn't breaking down? Try using another antenna system before you do anything else. Good luck!

Until next time, 73, all, de KB1UM. ☐

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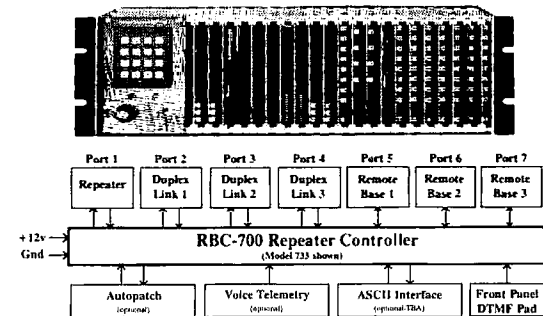


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HOANOKE, VA VE Exams will be held by the WCARS for upgrades only, at Hollins College at 8 PM. Pre-registration only. Contact **Fred L. Horton K24Y**, (703) 366-6266, or **Ben Giavaden N4BG**, Route 7, Roanoke VA 24022.

FEB 6

HAMPTON ROADS, VA Sign up for Hampton Roads Radio Assn's W5YI Exams. Please contact **Bill Runyon N4BDH**, (802) 487-8611, for details.

KNOXVILLE, TN WCARS VEC Exams, for up-grades only, will be held in Room B-129 at Pellissippi State Tech. Comm. College, Pellissippi Campus, at 10 AM, 10:20 AM, and 10:40 AM. Written elements at 11 AM. Please pre-register. Contact **Ray Adams N4BAQ**, (615) 688-7771, or **Rich Slover ND4F**, (615) 539-4821.

PARIS, TN Henry County H.S. will be the location for WCARS VEC Exams at 9 AM. Call **Mackie Gallimore AA4YF**, (901) 247-5489, or **Les Merrell KQ4F**, (901) 642-5966.

ST. CATHARINES, ONT., CANADA The Niagara Peninsula ARC Inc. will hold a Hamfest and Dinner-dance at the C.A.W. Hall, 124 Bunting Rd. Talk-in on 147.24/84. Dinner-dance

tickets by advance only. For info, please write **N.P.A.R.C. Inc.**, P.O. Box 692, St. Catharines, Ont. L2R 6Y3, Canada. Tel. (416) 934-3231, or **VE3KLM@VE3SNP**.

FEB 8

MARYVILLE, TN WCARS VEC Exams will begin at 7 PM at St. Andrews Church Hall, W. Broadway. Contact **Carroll Peabody W4PCA**, (615) 982-5839 for details.

FEB 13

GOSHEN, NY The Orange County ARC Computer Fair/Winter Hamfest will be held at John S. Burke Catholic H.S. on Fletcher St. Talk-in on 146.760 -600, plus 100 Hz tone. For more info, call **Jim Capicotto**, (914) 564-2707.

MARION, NC VEC Exams by WCARS will be held at Asheville Federal Bank Bldg., Main St. Contact **Cecil D. Potter WB4UCF**, (704) 724-4007.

WEST MEMPHIS, AK WCARS VEC Exams will be held at 9 AM at Rosewood United Methodist Church, 2303 E. Barton Ave. Get details from **Gene Bagley AB5BL**, (501) 739-4029 or **Rev. Richard Gregory AB5CH**, (501) 735-4060.

FEB 14

JASPER, TN WCARS VEC Exams will be held (by pre-registration only) at 1 PM at Jasper Public Library. Contact **Charles Woolen KD4XX**, (615) 942-5116, or **Wallace S. Brown KD4XV**, (615) 942-2836.

MANSFIELD, OH The Mansfield Mid-Winter Hamfest/Computer Show will start at 7 AM at the Richland Cnty. Fairgrounds. Advanced Ticket/Table Orders must be received and paid by Feb. 1st, 1993. Talk-in on W8WE 146.34/94 rpt. Contact **Dean Wrasse KB8MG**, 1094 Beal Rd., Mansfield OH 44905. Tel. (419) 589-2415 after 4 PM EST.

FEB 20

CHARLESTON, SC The Charleston ARS, Inc. will hold their Hamfest in the Geodesic Dome at Charlestowne Landing, 1500 Old Town Plantation Rd., from 8:30 AM-4 PM. Talk-in on 146.19/79, 144.65/145.25, and 147.87/27 MHz. Walk-in VE Exams will be given on the campus of Trident Tech. College at 11 AM. For Exam info, call (803) 871-4368 or (803) 572-1164. For Hamfest details, call **Jenny Myers**, (803) 747-2324, or **Linwood Sikes**, (803) 556-5566.

COLUMBIA, SC The Red Cross Bldg., Bull St., will be the location for

WCARS VEC Exams at 8:30 AM. Get details from **Ray Rogers N4WR**, (803) 345-3373.

NEW ALBANY, IN WCARS VE Exams will be held in Room 204, Knob View Bldg., Indiana U. South, Grant Line Rd., from 10 AM-2 PM. Contact **Dick Truax K8GVU**, (812) 246-6377, or "Mac" **McCrary NM9A**, (812) 944-6661.

SALEM, OR The Salem and Oregon Coast Emergency Repeater Assns. will sponsor their 1993 Ham Fair at the Polk Cnty. Fairgrounds, beginning at 9 AM. Talk-in on 146.26/86. For more info, write to: **Salem Repeater Assoc.**, P.O. Box 784, Salem OR 97308.

FEB 21

ASHEVILLE, NC WCARS VE Exams will take place AB Tech Room 134, Elm Bldg., at 2 PM. Get details from **Hary Dull AA2AB**, (704) 891-5481 or **Don Lovelace W4TMT**, (704) 765-5311.

DEARBORN, MI The Dearborn Civic Center will be the location for the Annual Swap 'n Shop sponsored by the Livonia ARC. Doors open from 8 AM-4 PM. VE Exams in the afternoon. Talk-in on 144.75/145.35 and 146.52 simplex. For more info, send 4 x 9 SASE to **Neil Coffin WA8GWL**, Livonia ARC.

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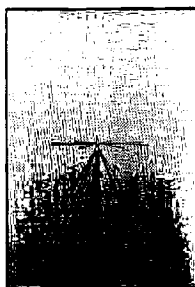
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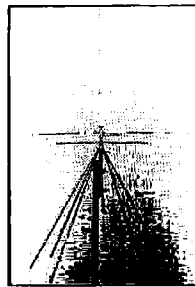
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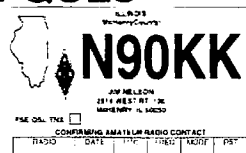
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NEW HYDE PARK, NY A Hamfest, sponsored by the Long Island Mobile ARC, will be held from 9 AM-4 PM at the Nassau County Police Activity League, 375 Denton Ave. Talk-in on 146.25/.85. For further info, please contact Neil Hartman WE2V, (516) 462-5549.

ROCK ISLAND, IL The 22nd annual Davenport (Iowa) ARC Hamfest will be held at the QCCA Expo Center. Large indoor Flea Market. Talk-in on the W0BXR 146.28/.88 rpt. Advance payment deadline is Feb. 15th. Contact Al Broendel N9OK, 2712 38th St., Rock Island IL 61201, for Exam details; or Talk-in on the W0BXR 146.04/.64 rpt. For Hamfest info, contact Kent Williams K9UOI, 4245 10th St., East Moline IL 61244.

FEB 27

DALTON, GA WCARS VE Exams will be held at 3 PM at Unity Baptist Church, Burleson Rd. No walk-ins. Contact Bert L. Coker N4BZJ, (706) 259-5625 or Harold W. Jones N4OTC, (706) 673-2291.

FEB 27-28

CINCINNATI, OH The ARRL 1993 Great Lakes Div. Convention will be held from 8:30 AM-5 PM (both days) at the Cincinnati Gardens Exhibition Center, Seymour Ave. and Langdon Farm Rd. Advance deadline is Feb. 17th. Contact Stan Cohen WD8QDQ, (513) 531-1011, or Joe Halpin WB3DU, (513) 851-1056.

MAR 6

ABSECON, NJ The Shore Points ARC will sponsor "Springfest '93" at Holy Spirit H.S. on Route 9. Doors open at 9 AM. Talk-in on 146.385/.985. For more info, write to: SPARC, P.O. Box 142, Absecon NJ 08201.

MAR 7

CUYAHOGA FALLS, OH The Cuyahoga Falls ARC 39th Annual Hamfest will be held at the St. V. Center, 3479 State Rd., from 7 AM-3 PM. Talk-in on 87/27. Get details from Bill Sovinsky K8JSL, 2305 24th St., Cuyahoga Falls OH 44223. Tel. (216) 923-3830.

NORTHAMPTON, MA A Hamfest will be held at Smith Voc. School, Rte 9, by the Mt. Tom ARA, beginning at 9 AM. VE Exams at 10 AM. Pre-register by calling (413) 245-3228. Talk-in on 146.34/.94. Get details from Jim K1MEA, 316 Main St., Easthampton MA 01027. Tel. (413) 527-3199, 7-9 PM.

MAR 13

FARGO, ND Hamfest '93, from 8 AM-3 PM, will be sponsored by Red River Radio Amateurs at The Bowler, 2630 S. Univ. Dr. Talk-in on 146.16/.76. Ask about Banquet tickets. Contact RRRR, P.O. Box 3215, Fargo ND 58108-3215. Tel. (218) 233-2584 7 PM-10 PM.

SPECIAL EVENT STATIONS

FEB 6-7

NORTH CENTRAL, WI A group of

hams will operate KF9MG on 28.360, 21.360, 7.260 and 38.860, to commemorate the 1993 Badger State Winter Games. For certificate, send QSL and large SASE to Mike KA9VFP, 1104 E. Lieg Ave., Shawano WI 54166.

FEB 13-14

CONCORD, NH The Contoocook Valley RC will celebrate the Grand Opening of the K1BKE Club station, at the Christa McAuliffe Planetarium during the New Hampshire QSO Party. Tune in on the 80-10 meter bands. For QSL, send a #10 SASE to Contoocook Valley RC, P.O. Box 88, Henniker NH 03242.

FEB 13-15

1993 NEW HAMPSHIRE QSO PARTY The NH ARA will sponsor this event from 1900 UTC Feb. 13th-0700 UTC Feb. 14th, and from 1400 UTC Feb. 14th-0200 UTC Feb. 15th. Open to all license classes. For more details, write to G.E.A.R.S., Conrad Ekstrom WB1GXM, P.O. Box 1076, Claremont NH 03743-1076.

FEB 19-21

MARQUETTE, MI The Hiawatha ARA will operate N8GBA from 1700Z Feb. 19th-1700Z Feb. 21st, to honor the UP 200 Sled Dog Championship. Use the lower end of the 10, 15, 20 and 40 meter phone bands. For a certificate, send a large SASE (with 2 stamps), to Richard Schwenke N8GBA, 21 Smith Ln., Marquette MI 49855.

FEB 20

BREMERTON, WA The North Kitsap ARC of Washington, will operate K7SXL at the Olympic College in conjunction with VoTech Week. Operating hours are from 1600Z to 2400Z. Frequencies: CW—3.65/.69, 7.04/.08, 14.04/.08, 21.04/.08, 28.025/.075 MHz; SSB—3.84/.88, 7.24/.28, 14.24/.28, 21.34/.38, 28.44/.48 MHz. Send QSL with SASE to North Kitsap ARC, P.O. Box 2268, Silverdale WA 98383-2268.

FEB 25-28

BROWNSVILLE, TX The Faulk Intermediate School ARC will operate N5SMH from 1400Z-2200Z, to commemorate the annual Charro Days Festival. Tune the General portion of 40, 20, 15, and Novice portion of the 10 meter bands. For Certificate, please send a QSL and SASE to Faulk Intermediate ARC, 2200 Roosevelt, Brownsville TX 78521.

FEB 27-MAR 2

HUNTSVILLE, TX The Huntsville ARS will operate WA5SAM from the campus of Sam Houston State U., from 0000Z Feb. 27th-2400Z Mar. 2nd, during the celebration of General Sam Houston's 200th birthday. Frequencies: Lower portion of the HF General phone subbands, and the Novice 10m phone subband. For a 3-color Certificate, send QSL and a 9 x 12 SASE; for a QSL card, send QSL and SASE, to HARS Special Event, P.O. Box 7516, Huntsville TX 77342-7516.

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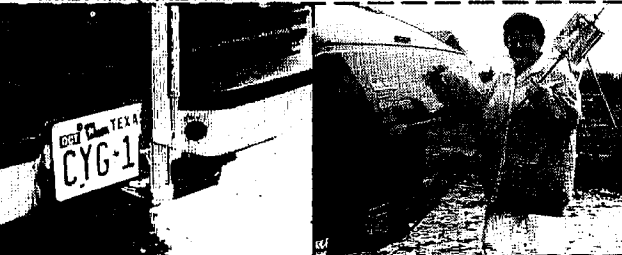


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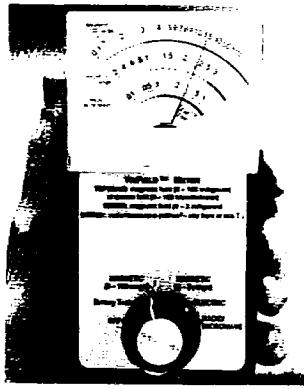
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RANDOM OUTPUT Continued from page 88

grammar and punctuation and use it. The same thing goes for a dictionary. When a manuscript crosses my desk with spelling errors and errors in basic grammar, my first thought is, "What else did this guy get wrong?"

Any manuscript you submit should be typed, double-spaced, on standard bond paper (like photocopy paper, not that thin so-called "typing paper" you can buy in stationery stores). It is becoming a common practice to include a computer disk containing the text file of your manuscript. IBM format is still the standard, but Macintosh is becoming more and more acceptable (especially in publishing). Include a copy of your word processing document (most can be transferred to whatever the publisher uses), and also include a standard ASCII text file, just to be sure.

It is considered unprofessional to submit the same article to more than one publisher at the same time. This is called "simultaneous submission" and most magazines (including 73) will not even consider a manuscript that is not offered exclusively to them. If the magazine rejects your article, then you can try again somewhere else. Make sure you mention that your article is being offered "exclusively to 73" in your cover letter (if you don't know what a cover letter is, buy a book on free-lance writing and look it up).

Every once in awhile we get an article where the author, in trying to sound like a "professional writer," will say something like, "... and I can offer you one-time worldwide rights to this fabulous article for only \$500!" This is an immediate tip-off that this person is not only unpub-

lished (no problem, many of 73's writers are first-time writers), but he is also uneducated (which is inexcusable, when you consider how many books about free-lance writing are available). Every magazine has standard policies regarding pay rates and publishing rights. 73 pays anywhere from \$50 for a short filler to over \$200 for longer, more involved articles (*Radio Fun* pays a bit less, usually between \$40 and \$120). We buy first-time North American and reprint rights. We do not negotiate (neither does any other magazine I know of). This is the way the business works, and anyone who tries to stipulate pay scale and publishing rights (at least in this market) is showing their ignorance.

What We Need—What We Don't Need

73 is always looking for good construction articles, antenna articles and tutorials on new or different modes. We love to get good "how to" pieces on club activities, amateur radio PR and just about any other subject that your fellow amateurs might benefit from. Make sure you include several clear photographs.

73 does not generally publish fiction, nostalgia or what are commonly referred to as "human interest stories." *Radio Fun* does publish a certain amount of human interest stories, though, so it wouldn't hurt to send one in.

I hope I've answered some of your questions. Even more, I hope I have prompted a few of you to take the plunge and try writing for us. You won't get rich, but I can tell you that there's nothing like the thrill of seeing your name in print the first time.

HAM HELP

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Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS Special Events Message Area, #11. (2400 baud, 8 data bits, no parity, 1 stop bit.) Tel. (603) 924-9343. Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

WANTED: Service Manual for Regency Scanner Model ACT T16K. Lisle T. Hines K2QLA, 11 Meadow Dr., Homer NY 13077-1214.

Service information wanted for: CONAIR Model 452 synthesized transceiver; SILTRONEX Model 90

VFO; SAILOR Model RT144 Marine transceiver. I will pay copy and shipping charges. Errol May, P.O. Box 362, Buffalo NY 14207-0362.

I need replacement or repair for the modulation transformer Heath Kit Apache transmitter TX-1, part #51-34 or equal. Please advise. Ben Gelfand, 81 Macy Rd., Briarcliff Manor NY 10510.

I just purchased a brand new 10 watt Motorola speaker Model SSN 2005B. No instruction sheets came with it. The pin-out info sent to me by Motorola hasn't been much help. No matter which wire I feed to my audio, I still can't get anything out of that speaker. Does anyone out there know of a simple hook-up to make use of the internal amplifier? N.B. Sadorian N6WGX, 500 Via Val Verde, Montebello CA 90640.

NEEDED: Manuals, schematics, anything for Hammarlund HQ120/HQ129 receiver, and Hallicrafters S-38C receiver. Thanks. Robin Okelly, 39400 Howard Rd., Marcola OR 97454. (503) 933-2217.

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NEVER SAY DIE

Continued from page 4

product, it's almost enough to make me wonder.

What To Do

This New Hampshire Economic Development Commission thing has been fun as well as frustrating. It's gotten me to read dozens of books, participate in dozens of conferences and subcommittee meetings, hear testimony from educational and financial experts, and work with some outstanding New Hampshire businessmen.

When I discovered that the Commission was being controlled by politicians and was going to be prevented from any possible success, I started sending the other Commission members reports on what I was discovering. I came up with creative proposals for solving our major state problems. I made proposals for cutting crime by about 80%, the cost of government by 50% within five years, education by 30% (with a far better educational result), eliminating welfare costs, creating thousands of new jobs, and so on. These reports were published in my book, *We the People Declare War on Our Lousy Government*.

Since publishing the book I've been continuing my reports to the Commission, with creative approaches to cutting health care costs, going into more detail on educational changes, and many other ideas. These are being published two or three times a month as *What To Do*, with six having been published as of this writing. If you're interested in this series they're available by subscription for \$10 a dozen. They're worth a hundred times that.

Of course the chances are that you really aren't interested in solutions to unemployment, crime, health care, our educational mess, our crooked Congress, the deficit, welfare, and so on. Not even interested in being able to talk about these things on the air since that might interrupt your memorized spiel. So I don't suppose you'll want to get the book or the newsletter. The book is \$10 from Uncle Wayne's, plus \$3 S/H per order. You can save money by getting a 20 wpm practice tape at the same time. And maybe a handbook. Something to read on those long February nights after the DX bands have died out.

Magnetic Fields . . . Again

An article in another ham rag pooh-poohed the dangers of being exposed to 60 Hertz magnetic fields, citing the IEEE as a source of the pooh. Just in case you have any question about magnetic fields causing your body harm, you should look up the new article by Paul Brodeur in the Dec. 7, 1992, issue of *The New Yorker* and see what's going on.

Paul's persistence broke the lid off the damage asbestos in schools was doing to our children, despite the insistence of scientists paid by the asbestos industry that there was no danger. He was opposed by a similar pattern of paid-off scientists when he blew the whistle on the Love Canal mess. Now it's the might of the electric power industry, which is faced

with who knows how many billions of dollars in litigation over the deaths it has knowingly caused, plus the costs of making our homes, schools, and work places safe. This will easily dwarf the savings and loan costs, so one can understand why the utilities are fighting such a desperate battle.

The government has been one of the big bad guys in all this . . . in the name of not causing panic. What would happen if Americans suddenly became aware that nearby power lines, pole transformers, and even their electric blankets are killing or damaging their children, causing miscarriages, and hastening their own deaths? Paul picked one particular California school for his article. The wonder to me is that, considering the evidence of such a high incidence of cancers and tumors in teachers working on the side of the school near the high tension lines, Paul was able to be so patient in reporting the government and power company cover-up.

The Dec. 14, 1992, issue of *U.S. News* (p. 94) added an even darker side to all this with a report on the effects to men's sperm when they drink alcohol, smoke cigarettes, or take other drugs. It's turning out, according to a March of Dimes research report, that these all have a profound influence on the resulting child. I've been writing about the impact of drugs and emotional problems on children in the prenatal period. Now I'm going to have to go back one more step and include preconception influences on a child's life.

If drugs and other shocks to the system during the preconception or prenatal periods can cause miscarriages, is there any question that when slightly less damage is done we're likely to have children with damaged DNA to try and raise and educate?

One of the shocks to every cell in our bodies is our exposure to power-line magnetic fields. These fields are affecting us . . . including men's sperm and women's eggs. They're affecting children permanently in the prenatal months. Later on they're gradually wounding or killing our children . . . and us.

I've been writing about this for several years. Have you been shrugging me off or have you gone out and bought a milligauss meter and swept your home for dangerous fields? How about your work place? I've recommended that ham clubs, as a public service, buy meters and offer to sweep local homes and offices. I haven't yet seen one single example of a club doing this reported in a club newsletter.

Here we are, an almost unknown hobby . . . one desperately in need of PR . . . and we're going to lengths to hasten our own death as a hobby by avoiding PR. I've mentioned lecturing to college classes on entrepreneurialism and finding that maybe two or three percent of the kids have ever even heard of amateur radio! Then there are the reports of police stopping mobile hams and not even knowing about the hobby. How much is it going to take to get ham clubs to start being responsible?

Have you already forgotten how the

ARRL refused to cooperate with a researcher checking into ham deaths by cancer to see if our proximity to magnetic fields might be hurting us? He found that hams were dying at double the average rate. Did you read that in *QST*? Well, it's no wonder if your ham shack is anything like mine. My main rig was okay, but my amplifier was radiating a death-dealing magnetic field. If a few ham widows started suing amplifier manufacturers we might see them at least suggesting that their amplifiers be positioned several feet from the operating position. A few hundred million dollars in lawsuits might get their attention.

In the meanwhile, we're sitting there being gradually and silently destroyed by the radiation around us. Worse, we're passing on this damage to our children in the form of damaged sperm.

Our amplifiers are particularly nasty death-dealers because not only are they radiating strong magnetic fields, but these fields are varying as we key our rigs or as we talk on sideband. The deaths near power switching stations and to power company workers has shown that transients are even more destructive to our cells than steady fields. You may have read the recent reports on facial cancers and their connection to electric razor use.

The power companies know what's going on. The asbestos industry knew for years what their product was doing to people. The cigarette industry has known for decades what their product has been doing, yet they're still publicly denying there's any proven relationship between cigarette smoking and death. Just coincidence. If the coincidence of death hits you, will your widow blame the manufacturer of your linear and go after them?

When the coincidence of a defective child hits, will the family go after the manufacturer of their electric blanket? Or the power company for putting that distribution transformer just outside their home? Or if it's a ham's child who's been harmed, will an amplifier company be asked to pay?

It's easy to recognize miscarriages and leukemia. It's easy to recognize brain cancer and other major reactions to magnetic fields. But what about the less than death-dealing changes all these carcinogens are causing? What about less obvious illnesses, personality problems, learning disabilities, dyslexia, and so on? There's no reason not to expect a whole array of abnormalities to result.

One of the leading research scientists in this field is Bill Adey K6UI. I've put a long list of the research papers he's authored or recommended on the 73 BBS. His research on the effects of distressing low levels of magnetic fields on cellular growth leaves no room for doubt that these fields are far more destructive than people ever imagined.

We know that every living cell lives and communicates via minute electric currents. We also know that when we put any kind of a conductor into a magnetic field it generates a voltage in the conductor. So why should we be even slightly surprised when we find that our body's cells are being screwed up

by stray magnetic fields . . . some of them of relatively enormous intensity. We should be surprised if this *didn't* mess things up.

What do you do about all this? (1) Get informed. Read the Brodeur article. Get the book *Electromagnetic Man* by Cyril Smith, St. Martin's Press 1989, 344p, and also *Warning: The Electricity Around You May Be Hazardous to Your Health* by Ellen Sugarman, Simon & Schuster Fireside 1992, 238p, \$11. (2) Get or build a milligauss meter . . . or get your club to buy one. (3) Go on your local talk radio programs and get the word out, offering a club service to check on magnetic fields in homes, work places and particularly schools near high tension power lines. (4) Let me know what successes (or failures) you've had. (5) Get coverage in your local newspapers, showing this as a public service by your ham club. (6) Meet with your local school principal and arrange to talk with the kids about magnetic field dangers . . . and please don't forget to put in a big plug for amateur radio. It's a safe hobby as long as you keep the RF in the shack down and your death-dealing linear amplifier several feet from where you operate.

Money Talks . . . Again

In case you haven't been keeping up with the magnetic field situation, you might like to know that the Environmental Protection Agency (EPA) had a report ready to release citing electromagnetic fields as a probable carcinogen. This aspect of the report was blocked by the Bush White House Office of Science and Technology Policy on the basis that it "would alarm the public."

On September 30, 1992, Sweden's National Board for Industrial and Technical Development said they would be acting on the assumption that there is a connection between exposure to power frequency magnetic fields and cancer, in particular childhood cancer. This was the result of a five-year research program, following over 400,000 people, which showed a clear relationship between magnetic fields and childhood leukemia. They found that children exposed to more than one milligauss had twice the risk of leukemia. At two milligauss it went to three times the risk. Men exposed to 2.9 milligauss had three times the leukemia of those exposed to less than 1.6 milligauss.

So how about TV and computer terminals? In Helsinki the Institute of Occupational Health found that women exposed to three milligauss suffered miscarriages at three-and-a-half times the rate of those exposed to one milligauss . . . a result quite similar to the Swedish leukemia rate. The University of Adelaide's Department of Community Medicine found women working with computer monitors developing brain tumors at nearly five times the expected rate. There's also good reason to suspect that much of the elevated incidence of breast cancer may be VDT related, though I know of no study having yet been done to find out about that.

Will all this be enough to get the White House to back off? Will it force the elec-

tric industry to at least stop trying to stonewall the problem? In the meantime, thousands of kids are dying of cancer and probably tens of thousands of adults. Worse, we haven't even a clue as yet as to what cellular damage these fields are causing. We only count the dead, not the wounded. As I've pointed out before, we have no reason whatever to expect that children born of mothers exposed to these magnetic fields are going to be other than genetically damaged . . . it's just that the damage wasn't serious enough to cause a miscarriage.

All of which brings us to your home and your ham shack. If you have a pole transformer near your house, it's time to either get it moved or move your family. Check it out with a gaussmeter and make sure you're living in an under-one-milligauss field. Gauss out your shack, too. You're certainly going to have to move your linear several feet from your operating position, even if it's a nuisance to have to get up to tune it. And if your children are going to schools which are near high tension lines it's time for them to change schools.

In case you missed it, not only are these fields damaging your body, they're even damaging your sperm . . . which means that you have a good chance of permanently damaging your children's lives even before they're conceived. Of course cigarettes, alcohol and other drugs also affect your sperm and your wife's eggs before conception, or have you missed the recent March of Dimes research report?

What about HTs? We don't know yet, but there are some good reasons to believe that the use of subaudible tones may damage brain cells. Research has shown that our cells are able to detect HF, VHF, UHF and microwave energies, but it may be the demodulated components which cause damage.

What does it take to generate one milligauss? Well, I measure 1 mG at 30" from my laser printer and 2 mG at 18". I haven't used my laptop PowerBook Mac in my lap since measuring 25 mG leaking out the bottom. There's about 5 mG by the keys, and less than 1 mG at 3" in front of it. My electric blanket measures 150 mG . . . a death trap.

Help Wanted

Whoo, are we short-handed! With both 73 and Radio Fun growing, we need help. And that's not to even mention a couple dozen other projects we're all working on . . . like a "Wayne Green's World" TV series which will be promoting amateur radio, my book and music; a new series of amateur radio books; new publications in the vacation, video, and educational industries, and so on.

I'd like to find a couple hams with experience in newer communications modes . . . like packet, RTTY, and repeaters. An ability to read and write is critical, as is the ability to meet deadlines and have at least an outward appearance of being a human being. An Extra class license will be acceptable only if you cheated on the code test, otherwise we'll have to administer some tests to mea-

sure the extent of the inevitable brain damage which results from CW use . . . a semi-vegetative state known as Morse-Cauliflower Brain (MCB). This can be detected by (a) a loss of a sense of humor; (b) a hating of 73; (c) a totally without factual basis conviction that not everything I write is true.

If you're interested in living in New Hampshire, where we have the highest quality-of-living index of all 50 states; where we have vacationers driving for hundreds of miles to enjoy our state four seasons of the year, let me hear from you. Let me know what you'd like to do and what you've done so far that would encourage me to think you might be able to actually do what you propose. What have you accomplished in life so far? What have you to show? No, I'm not interested in the usual baloney resumes. I want some proof that you can write . . . that you have a sense of humor . . . and that you have initiative. And what's the big reward, if you win? A whole lot of work . . . work you'll love. Naturally this is made up for by a generous pay schedule . . . not! You and your family won't starve, but keep in mind that two of our staff had to sell their yachts recently. But isn't it a whole lot better to be doing something you really enjoy rather than that miserable odd job you've been wasting your life on so far? I know that once I got snookered into amateur radio publishing I was a goner for life.

The Great Twins Fallacy

Yes, I know you have absolutely no in-

terest in this, but who else am I going to tell? This has to do with all this baloney you've been reading . . . which makes the perhaps over-generous assumption that you have been reading . . . about what scientists have learned about genetics by studying identical twins separated at birth.

The results of the studies have been amazing. Twins turn out to often smoke the same cigarette brand, be married to wives with the same names, name their children the same names, and so on. Golly, how astounding that all this is genetic.

Even the gays have been cheering at studies which show that about 50% of identical twins are both gay when one is. Genetics at work, obviously.

Maybe. Maybe not. I think we may be able to rule out a lot of the coincidences between twins if we start investigating the possibility that there is some sort of completely unconscious communications between twins. That isn't too difficult a concept to consider, is it? Since there are millions of people who've experienced some kind of ESP communications, we know that there are times when this happens. We haven't had much luck in repeating it on demand. Scientists are very unhappy with non-repeatable experiments. Most of 'em refuse to accept anything non-repeatable as even being possible.

Having personally experienced such communications where there was not even the remotest possibility for it to be a coincidence, I know it's possible. We just have to

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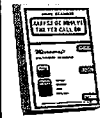
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learn more about it . . . and refusing to investigate the phenomenon because some scientists believe it's impossible isn't a very good scientific approach.

Anyway, the next time you read a report on how amazingly similar twins separated at birth are, forget the genetic implications. Sure, there may be some, but they aren't going to be isolated this way.

We do need to see if we can find out how people can communicate on a subconscious level. If we can make this repeatable we may be able to start sending QSL cards to confirm mental communications. Alas, at the pace we're moving now in our research on the mind it'll be another 50 years before we learn enough to harness its incredible power. Maybe a hundred.

Music, Music, Music

A note from Rob AA6BN claims that not all hams are nerds with no interests but ham radio, and henceforth I should tell you about my new music magazine. Now, while I doubt that Rob has one scintilla of evidence to back up his obviously ill-considered claim, on the mere wildest chance that somewhere out there, despite the dictates of reason, some of you might be interested in music, I'll tell you about one of my new projects.

Yes, I know, we all like music. But there's a whole of a difference between liking music and actually buying records . . . they're CDs these days. When I was a kid I liked music. I even bought a 12" RCA Red Seal 78 record of Strauss' Tales of the Vienna Woods and his Blue Danube Waltz when I was 12, to play on the lam-

ily wind-up Victrola.

I didn't get involved seriously in buying records until they threw us off the air when WWII started. Unable to ham, I turned to music and building hi-fi systems. In the 1950s, in addition to helping pioneer RTTY, I manufactured a new kind of loudspeaker which did very well. Alas, my RTTY interest sucked me into ham publishing.

When the compact disc came along in 1982 I started a magazine to help speed its acceptance. It eventually became the country's leading music magazine. Since I enjoy starting new publications more than running mature ones, I sold *CD Review* last year and started a new music magazine. If you're into buying music you'll enjoy, it since we mercifully review over 200 CDs each month. I know you'll find this hard to believe, but we don't take ourselves seriously. It's kinda like *Mad*.

The reader uproar over my editorials disappearing from *CD Review* got us to capitalize on this in our *Secret Guide To Music*. Our readership has turned out to be a bunch of men (95%) who buy 7.6 CDs a month, average age of 41, average \$57,000 income, 68% like classical music, and so on. If you'd like to see a copy drop me a line. You've been wanting to write anyway to tell me how you don't always agree with my 73 editorials, so this is a good excuse. My *Guide* editorials are shorter.

The same basic drive that keeps me publishing 73, a genetic defect which forces me to try and get others to share things I enjoy, is at work in my pushing people to

enjoy music. So I urge my readers to try classical music, ragtime, theater organ, and so on. Like a good book, a recording is something you can enjoy for the rest of your life.

To help make it easy for my readers to find interesting music, I've a mail order service. Far's I know, it's the only place any one can buy CDs and return them if they don't like them for a measly \$1 restocking charge. Love it or return it. And I've been turning out samplers to help people discover music they might otherwise have missed. We've produced nearly a hundred samplers so far and they're all totally, completely 100% free . . . except for an insignificant, hardly worth mentioning, \$3.89 S/H.

In A Rut?

I'm not sure why so many people get into ruts. I had a great time working DX, but after 300 countries confirmed I lost interest. I'd done that. I had a ball with RTTY for several years . . . then I'd done that. DXpeditions were fabulous fun. I won't forget one minute of any of 'em. But I've done that. It was exciting working seven states on 10 GHz, now that's done. I loved contests and won certificates for DXing, Sweepstakes, and VHF. Done. OSCAR was a challenge and great fun. I had one of the early repeaters back in 1969. Then there was Navy MARS. It was enormous fun pioneering NBFM, SSB and slow-scan. So I keep urging you to try new things . . . to find new excitement in our hobby, as I have. I tried aeronautical mobile in my own plane . . . fun. I've been hot air ballooning with my HT

and used it while skiing the slopes. If someone comes up with something new to do in amateur radio I'll probably hop aboard.

Then I talk to hams who have been exchanging signal reports and handles for 20 years or so and have done little else. How can I open their minds to the fun of trying satellite communications? Of working RTTY and packet? Of getting on top of a mountain and working DX on 10 GHz . . . way over in a neighboring state a hundred miles away? Of looking for a temperature inversion band opening and working through a repeater five hundred miles away? Of working a thousand miles or so on 2 meters via aurora skip? Or seeing if you can work 100 countries in one weekend? How about some 75m DXing? Now there's a real challenge! To do much of this you have to go up to the higher bands, make a DX contact, and then get 'em to come down to 75. I'll never forget the thrill of talking to my home station on 75m while visiting Ray VK3ATN and hearing W2NSD/1 coming through 5/9+. Wow! Have I ever shown you the aerial pictures I took of Ray's amazing antenna farm? He did a great job of working the U.S. on 2 meters via moonbounce.

Where's your spirit of adventure? How can I get you out of a rut?

And the same thing goes for music. There are a couple hundred different kinds of music. Some aren't all that exciting, but there's a lot of fabulous music you've never heard just waiting for you to reach out. Have you ever heard Gottschalk's Tarantella? How about Nazareth's music? Delius? Gliere?

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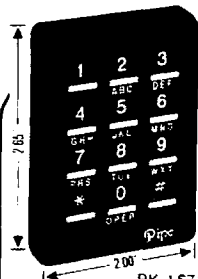
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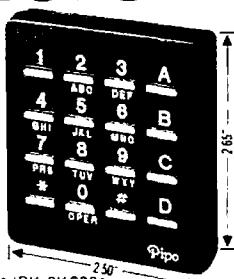
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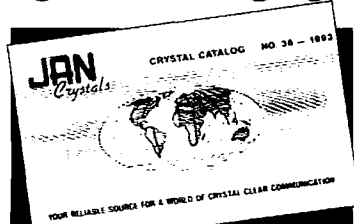
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Build a Super-Horn Antenna for 10 GHz Continued from page 14

waveguide adaptor that takes waveguide down to an SMA fitting.

Road Test

Finally, we were off to the test area where we could tune into the N6CA beacon about 40 miles away. Using a Kenwood 751 with the SSB Electronics transverter, we could barely make out the beacon with an omnidirectional 10 GHz antenna. A small ARR horn improved signals up to an S-4 level and a longer military 10 GHz horn (of a much more slender design than conventional horns) gave us an S-6 signal with tight directionality. We were now ready to give the Super-Horn the big test. We had quite a time getting it lined up with the transverter so that we didn't stress the delicate SMA connector. We knew we had a winner as we inched the equipment up to the horn: Reception to the distant beacon was coming in loud and clear, even before we were on the waveguide!

When the connection was made, the big horn



Photo G. No, this is not a rocket-assisted station wagon. Suzy N6GLF operates portable 10 GHz SSB using the Super Horn antenna.

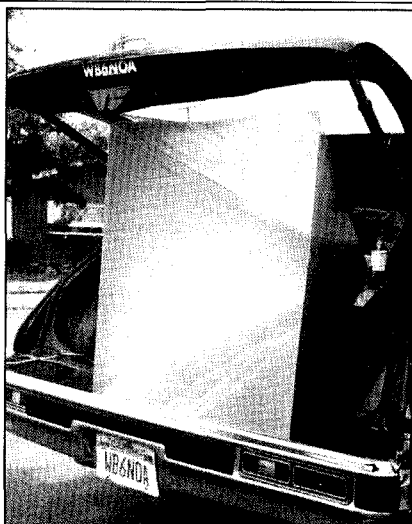
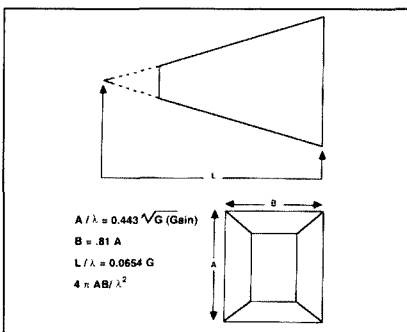


Photo H. Side view of the Super Horn antenna. The two halves are joined at the top and bottom for maximum strength (i.e. each half has two bends in it).



pulled in the beacon at a fantastic S-9 level, better than we had anticipated. Side lobes were not as clean as the smaller horn, but at 10 GHz, that might be an advantage to find distant signals.

If you are already on 10 GHz, take out your standard horn antenna and see what you might do to easily extend its sides for increased gain.

Figure 3. An existing horn antenna can be increased in size for improved gain by extending the sides.

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Notes from FN42

I missed a very interesting meeting several nights ago. Some of the local hams decided to see if there were other hams in the area who might want to develop an amateur radio club. I had to be very honest with them and say that I had heard that organized clubs don't seem to make it here in the Keene, New Hampshire, area. Many have started and many have failed.

That didn't seem to deter them. Through a mass mailing of 250 letters to hams listed in a ham data base for this area, 30 replied that they would be interested and would show up at the informational meeting. One of the hams, who is a DJ for one of the local FM broadcast stations, was able to get a meeting room at a local motel.

When the evening came there was a BIG surprise waiting for the organizers. Over 50 hams showed up, including the mayor, who is also a ham. I have only received tidbits of what happened at the meeting, but I understand that it was SRO (Standing Room Only).

As I am writing this, some of the hams who were at the meeting are discussing it on 75 meters. The discussion is very positive, even exciting! I have been involved in the starting of several clubs, ham and non-ham. It is always exciting to see that others share your visions. Most of the other clubs had a very definite purpose, such as DXing, contesting, repeater operation, etc., but this one, from the feeling of the group, seems to go in many different directions. Many of the attendees would like to learn more about ATV, traffic handling, packet, contesting, DXing, etc. Luckily we have many hams in the local area who have expertise in many of those areas, such as Bill Brown WB8ELK, ATVer and high altitude balloon experimenter; Dawn K1TQY and Alan W1FYR, who are dynamite with traffic handling; Joel WA1ZYX, Scott WA1YTW, and Buzz WA1NHP, who are actively involved in packet; and many hams who have been contesting and DXing for years, both HF and VHF/UHF. Plus, they don't want to spend most of the meetings discussing the management aspects of making it all happen.

I would be very remiss if I didn't mention the names and call signs of many of the hams who have had leading and supporting roles in this beginning effort: Doug and Deborah KD1GJ and N1NGC, Randy N1KWF, Gary and Karen KD1JR and KB1AGP, Bob KA1ZMF, Paul WK1P, Peter KA1ZRI, Buzz WA1NHP, Joel WA1ZYX, Scott and Ann WA1YTW and KA1QQH, and Bruce WA1YZN. If I left someone out of this list it is certainly not intentional.

As I review what I have written, one word seems to stand out in the previ-

ous paragraph, and that word is "supporting." An organization is only as good as the members supporting the leadership. Organizations live and breathe with the members, not the leaders. The leaders live only with the continued support of the members. How can you be a leader when there is no organization to lead?

I plan to continue my discussion of the starting of new clubs in the future because there may be many of you who wish that there was a club in your area but there isn't. It isn't that hard to start one; the hardest part is to keep it going! The club only continues if its members want it to continue. I just dug out my trusty Webster's dictionary and a short definition for "club" is: "persons organized together"; "organized" means: "place in orderly arrangement, unite"; and "together" means: "in a group, at the same time, with one another." That means that the members have to get involved and continue to be involved. And those of you who are presently members of a club, please read or re-read my January column and the letter in "Roundup" from Rainier Bautista DY9CKQ titled "CO, CO, CO... OUR RADIO CLUB IS DYING!" and don't let your club get to the level that OSCAR-MARBEL got to. Get involved and keep involved!—Arnie N1BAC.

Roundup

People's Republic of China China News from BY1QH, edited by Rick Hunter: There are two Tsinghua Universities in China—one is in Beijing, where BY1QH is located; and the other is in Hsingchu, Taiwan. October 17 and 18 saw a first-ever Jamboree-On-The-Air (JOTA) activity between the two universities on both sides of the Taiwan Straits. JOTA is annually sponsored by the World Scout Bureau and anyone may take part. A number of students spoke to each other and talked about things of interest and curiosity. Many would like to build up a "pen-pal bridge" between individuals and the student-run associations. Wang BV3AV, an EE graduate student, devoted a lot of his time getting things organized for this unprecedented 10-hour QSO.

BY1QH is preparing for the installation of an SSTV station but we are lacking some information on activating this mode. We need to learn about the scan converter and how the equipment is connected. Can anyone send us this information? We have heard that some articles were published in 73 in the past but we have no way of researching this. I'll try to do some research on this.—Arnie

Amateur radio is still a brand-new concept to many young men and women here in the People's Republic. As the country becomes more prosperous, we believe that there will be lots of people getting involved in ham radio as soon as the government allows. Under such circumstances, we

truly hope that our friends in the USA, Canada, Australia, Europe, and elsewhere come and visit us. We would love to have those visitors talk to our students in either English or Mandarin and spread the knowledge. Tsinghua University has a small but nice hotel on the campus which is a good place to stay. BY1QH will make arrangements for you, just let us know as early as possible.

VE7UBC, the University of British Columbia (UBC) Amateur Radio Society and BY1QH have successfully re-established the weekly schedule we held several years ago. Doug and Darby, two UBC graduates, talked with Rick on November 11th. The Canadians kindly introduced two other active Canadian university ARS groups—Concordia University ARS in Montreal and Ryerson Polytechnic ARS in Toronto. We are looking forward to getting in contact with them via the packet BBS system. BY1QH is very eager to get in touch with other university ARS groups. It would be great fun to talk with friends of the same age.

We are very happy to have received many messages via packet radio, especially from Jeff AA1LG of the Bronx High School of Science Amateur Radio Club. TUARC congratulates them for their activities and would definitely like to stay in touch.

We will be starting an amateur radio class at TUARC very shortly. The "two-boy vs. two-girl" combination will add more fun to BY1QH. All of them are students at Tsinghua and have a good command of English and great enthusiasm about SSB QSOs. I think that it is great that two YLs are interested in becoming hams because the vast majority are males.

Thanks to all who have been supporting our efforts. We would like to hear from all of you. Contact us via mail at: Rick Hunter, Room 316, Building 25, Tsinghua University, Beijing 100084, Peoples Republic of China, or via packet: BY1QH @ JA5TX.JPN.AS, or to George VE7CIZ @ VE7KIT#VANC.BC.CAN.NA.

Switzerland From the International Telecommunication Union Press: Moldova, Bosnia and Herzegovina have joined the International Telecommunication Union (ITU). The instruments of accession of the governments of the Republic of Moldova and of the Republic of Bosnia and Herzegovina were both deposited with the ITU on 20 October 1992, bring ITU membership to 174 countries. Moldova (also known as Moldavia), a former USSR republic, is bordered in the east and south by the Ukraine and on the west by Romania; it has an area of 33,700 square kilometers and a population of 4,335,360 (1989). Its capital is Kishinev. It became independent in August 1991 and became a member of the Community of Independent States (CIS) in December 1991. Bosnia Herzegovina is south-east of Croatia and west-northwest of Yugoslavia. Its area is 51,129 square kilometers and it has a population of 4,335,000 (1991). Its capital is Sarajevo.

REPUBLIC OF KOREA

Byong-Joo Cho HL5AP
Room 401 CO Building
157-7, Kwangan 2 Dong, Nam-Ku
Pusan 608-102
Republic of Korea

Happy New Year to all. There is a new club in Pusan! The Pusan Packet Users Club has had two meetings so far. The second meeting was at the Pusan Yacht Harbor (branch office of the KARL) on September 26, 1992.

The club packet repeater station is set up on the mountain of "Hwang Ryong San," and the frequency is 144.74 FM, 24 hours a day. We are also planning to build a repeater on 435 MHz as a duplex system soon. HL5BMM donated a transceiver to the club for this purpose.

My station now consists of an IBM PC/XT for data communications with an MFJ-1278. These are hooked into my new Kenwood TS-850SAT. I also operate portable with my Yaesu FT-290 at 2.5 watts. I am hoping to meet many new hams on 160m CW, because Korean hams can operate between 1800-1820 kHz.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel

Six Meter Expansion Over a year ago a 50-kHz-wide splinter of 6 meters was opened in Israel, but for the benefit of Class "A" licensees only. Now this license class has a 200-kHz-wide band to work in—50.000 to 50.200 MHz. The Class "B" ticket holders have been allowed into the band (and presumably the Class "D" Technical codeless license—the first exams were just passed a week before the writing of this) from 50.100 to 50.150 MHz. In all cases, maximum output power may not exceed 25 watts and all operations on this band shall be on a secondary non-interfering basis.

Asia 100—Ahziv Island Since the 19th of September, 4X is also on the IOTA (Islands On The Air) map. It was the first time that, for several hours, Israeli radio amateurs activated a station from Ahziv Island, about one kilometer off the coast of Israel, in the Mediterranean Sea. Ahziv Island is not more than a rock about 100 by 60 meters, just barely above the surface of the sea, and on stormy days is completely covered by waves. Headed by Dov Gavish 4Z4DX, aided by volunteers Mark 4Z4KX, Eliezer 4X6DL, Gershon 4X6PW, Moni 4X6ZK, and Ziv 4Z9GAB, the group sailed for the offshore island, erected some dipoles and got on the air.

Ahziv Island is one of an island group in that area protected as a nature reserve, and as such it was forbidden to drill any holes for anchoring the antennas. Everything had to be self-supporting or tied by strings to rock protrusions. A lot of red tape had to be cut in order to procure permission from the various authorities. The easiest to obtain, of course, was from the Ministry of Communications, always ready to aid and issue licenses

with special calls, like the one used here, 4X0AI, standing for "Ahziv Island." All in all, some 1,050 QSOs were made, 330 of them in CW. Four bands could be activated; namely, 21, 14, 18, and 7 MHz, while operating most of the time simultaneously with two transceivers and, for short periods, even with three. The group managed in this short period of time (only 390 minutes of activity, the time permitted to remain on this island) to work 56 countries. There was no permission to stay overnight, just for those few hours. If the authorities check and find out that no damage whatsoever was done to the island, we can hope that repeats of this activity will be permitted in the future to enable all the collectors of IOTA QSOs to receive the needed QSL cards that will be sent for each and every contact.

In summation: The activity was highly successful and all the participants are congratulated on a job well done.

Israel Represented at Friedrichshafen The Ham Radio Fair at Friedrichshafen, Germany, has been rightfully called "Europe's Dayton," and attracts hams from all over the world. Chock-full of manufacturers' exhibits, national radio societies' booths, a huge flea market, and special presentations, this ham radio haven gets larger year after year.

This past summer the Israel Amateur Radio Club had an official booth there with our official representative being Naomi Dor 4X6DW. Naomi is

well-known as one of the net controllers of the European DX Net meeting daily on 14.246 MHz. Her OM, by the way, is 4Z4 Kilo Banana. Also on hand were Shalom Meltzer 4X4MS, well-known for his operations from many African countries, Ahron and Shoshana Kirschner 4X1AT and 4X6OL, Ruth and Joseph Obstfeld (the IARC chairman) 4X4CM and 4X6KJ, Yitzhak Markado 4X6ZH, and Gad Golan 4X6RT.

At the booth were films on special activities of the IARC, Keren Kayemet (National Land Reclamation Authority) films on Israel, 6,000 mini chocolate bars weighing 250 kilos (a gift from Elite, the country's largest producer of sweets) and miniature bottles of Israeli wines. Of course, there were specimens of all the different Israeli diplomas, IARC publications, and other goodies from the Israel Amateur Radio Club.

OKINAWA

JAPAN

David Cowhig 7J6CBQ
US Consulate General Naha
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FPO AP 96372-0840

Okinawan Hams Celebrate the Re-Opening of Shuri Castle The re-opening of Shuri Castle was the big event during the month of November 1992 in Okinawa. The kings of the Ryukyu Kingdom, an independent state until the 1879 merger with Japan, regularly entertained emis-

saries from the Emperor of China in Shuri Castle. The castle, first built in 1395 and restored several times thereafter, was destroyed during a 1945 battle in which one-third of the civilian population perished. A group of Okinawa hams went on the air as JR6RL from Shuri Castle on the weekend of November 14-15 to celebrate the reopening of the castle to the public. Okinawans are rediscovering their strong links to China and their history as an important trading nation from the 14th through the 17th centuries. A novel and upcoming NHK national TV series entitled "The Winds of the Ryukyus" has aroused intense interest in the Ryukyu kingdom, which as a trading nation absorbed the cultures of China, Indonesia, and Thailand and eventually created a distinct Okinawan culture.

Okinawa lies 300 miles off the Chinese coast and halfway between Kyushu, Japan's southernmost large island, and Taiwan. Okinawa prefecture, the southernmost of Japan's 47 prefectures, has a population of over one million. Okinawa was for many centuries a borderland between China and Japan so Chinese influence on Okinawan history, culture and religion is very strong.

On the HF bands Chinese stations are often stronger than Tokyo stations. There are only about 70 stations, all club stations of one kind or another, in mainland China, but with many operators per station Chinese stations are often heard on the ham bands. Taiwan

now has 1,700 licensed hams and 1,200 ham stations, so much activity from Taiwan and mainland China is to be heard here on the HF bands. An Okinawan station can easily join in a round table with Chinese mainland and Taiwanese stations.

I often hear Japanese hams practice their Chinese with Chinese hams. The NHK Educational TV network has a weekly "learn Chinese" program—as it does for a variety of other languages, including English, Russian, Italian, and Spanish. So these hams can work on their Chinese systematically in a formal course right at home and then get on the air for language practice.

So far I have been able to exercise my Chinese in talking with stations in Tianjin, Nanjing, Shanghai, Fuzhou, and Hangzhou. I was worried about understanding Chinese ham slang, but they will oftentimes use English for special ham words. In Taiwan, hams are not only called hams but are also known as the sausage tribe (xiangchangzu). China now has about 70 club stations in schools, local government sports associations, and some factories. Most of the Chinese hams I have talked with have been YLs. They tell me that YLs are fully half the Chinese ham population. Wang Min, an engineering student at Zhigong University in Tianjin, a port city near Beijing, told me that of the 30 members of the Zhigong University ham radio club, 20 are YLs. China should be an excellent recruiting ground for the Young Ladies Radio League!

73

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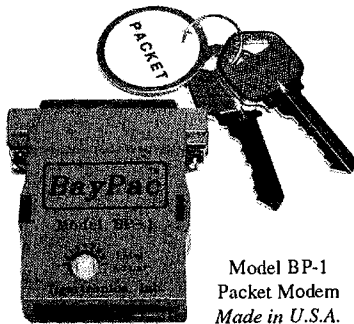
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Mixers and Other Small Case Devices

This month I will cover mixers: prepackaged, home-brewed, and a few others. Applications for mixers are numerous. I will show how a surplus mixer can be used at 10 GHz in my home-brewed station. Most of the mixers to be covered will be the small commercially available hermetically-sealed types associated with Mini-Circuits Labs. Be aware that these are not the only types available as they do not need to be hermetically-sealed to work at high frequencies.

There is some confusion associated with this type of device in that not all devices in similar packages are mixers. They can be power splitters, mixers, phase splitters, attenuators and even amplifiers. These devices have become quite common in the surplus market, making their use very popular in most amateur design projects. Take a look in any *ARRL Handbook* for the last 10 years and you will find articles peppered with SRA-1s or similar type mixers. The beauty of these devices is that if you have to go out and purchase them, they are available right off the shelf and the cost is not prohibitive: under the \$20 mark.

First, let's cover mixers of the SRA-1 type. This type is made for operation up to 500 MHz and is one of the most popular mixers produced to date. It has been used and observed in so many different types of projects over the last 10 years that I think it is a household word synonymous with mixer.

The SRA-1 and its cousins are produced by Mini-Circuits Labs and are constructed using the double-balanced configuration shown in Figure 1. Case styles may vary, as well as the frequency and level (dBm) han-

dling capabilities of similar type devices available from them. Be warned: Mixers are not the only devices that can occupy similar case styles. I have observed people purchasing surplus PC boards with devices looking like mixers on them, only to find out later that they were not mixers at all. A quick scan of a catalog will identify the device you have. I find that attenuators, phase splitters and mixers comprise the most common devices found in surplus. I have not yet observed amplifiers in these case styles. Mini-Circuits Labs does provide several series of amplifiers fully packaged and some of them look very similar in case style to our mixer cases, but I have never seen one in surplus.

If you can remember all the part numbers in the catalogs you have no problem identifying surplus parts. However, we are not computers and we don't carry data books with us so just try to recall some of the more memorable devices when out scrounging. What I try to do is generalize my memory bank to common types and use the catalogs for others. There are just too many part numbers and variations to try and remember. Don't memorize the more specialized components, just form some mental note on the most popular devices to look for in surplus. That limits most mixers to the GRA, SRA, SBL, TAK, TSM, TFM and SAM type mixers. The following prefix on these mixers is not important at this time if the highest frequency of use is 500 MHz. Most mixers will work to these limits. Sure, some go much lower but the odds are that the device you will find is good to 500 MHz. The SRA-2000 and the SBL-11 are good examples of mixers that go up to 2 GHz and seem to populate surplus boards.

Re-Pack Mixers

Re-packs, as I call them, are nothing more than commercial mixers in a

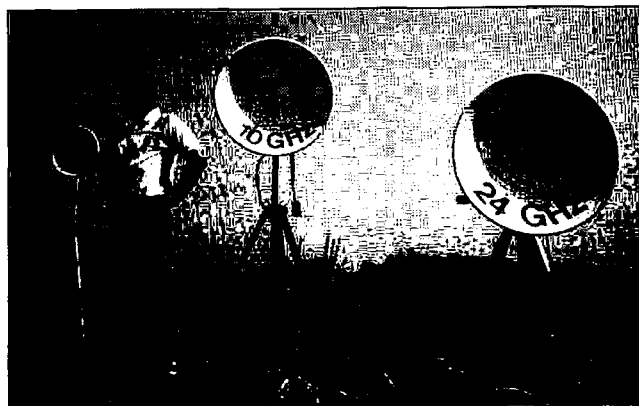


Photo A. OZ1UM with his microwave setup in Denmark for 10, 24, and 47 GHz operation.

small pin configuration housing placed in a container that connects the pins to coaxial connectors. Most of the re-pack mixers use some of the previously described mixer products as their main component. Some of these mixers with coaxial connectors are denoted with the prefix of ZLW, ZAD, ZEM, and ZFM identifiers. They are constructed with easy-to-use coaxial connectors for bench tests and lots of other applications requiring sturdy packages and quick connect/disconnect coaxial connectors. They can be furnished with almost any type of coaxial connector. These mixers are usually much harder to locate in surplus than the pin-packaged ones previously described, and when they are available they have a higher price.

As I stated before, power splitters or power dividers are packaged in similar case styles and can be confused quite easily. The differences in some of them lie in the labeling of the component parts, such as PSC, or PSCQ or PSCJ. If the part you find has a "P" in the part identifier, you can be assured it is some form of phase splitter or combiner. There are variations such as the PDC identifier, which is a directional coupler. Again, packaged directional couplers use ZFDC, still retaining the "DC" notation directional coupler. It's just like the "PSC" or "SC" part denoting the splitter coupler above. With most Mini-Circuits components you can make a basic determination on the function by word similarity of their code identifier.

This can be depressing. Possibly I am giving up part of my gray matter for ransom by this description, but that's how I try to group the miniature parts in my mind. The trick is to remember in generalities how the scheme works and make some rules for your use. It's necessary when looking at surplus PC boards as you never seem to have the proper catalog along when you find something interesting.

There are exceptions to any rule but in this case they seem to be unusual components and there aren't enough of them to worry about. For detailed information, contact: Mini-Circuits Labs, P. O. Box 350166, Brooklyn NY 11235-0003; (718) 934-4500.

Be aware that there are also filters,

RF solid-state switches, and even RF transformers available. If new demands are present and the market wants them I suspect almost anything that can be produced will be put into a similar package for ease of use. Please note that this is not the only company that manufactures this device but it is the most popular from both an advertising and a surplus availability basis. See Figure 2 for some of the more popular case styles. These units all look alike and even have the same pin counting method, so just consult a catalog for your device on pinout connections. In most cases a blue insulating bead lets you know which pin is pin #1.

Open-Frame Mixers

The market is also saturated with open-frame mixers constructed on small PC boards in the open. They are used in cable TV converters and even in amateur radio transceivers. These are configured the same but are constructed using discreet components instead of the prepackaged types. I am not sure that this is cost effective, but in any case the circuitry is quite the same. The basic diode mixer is connected in a quad double-balanced mixer configuration. This ring of four diodes has input and output toroid transformers connected in such a way as to form three ports.

The primaries of these two transformers are the actual input and output for the mixer, while the center tap of one secondary serves as the third port, the IF port. The other secondary center tap is grounded in normal operation. The input is the "L" or local oscillator and the output is the "RF" port. Keep in mind that the RF and IF ports are bidirectional. They can be used for receiving and transmitting.

See Table 1 for port identification. As shown in Table 1, RF and IF terminals are bidirectional—that is, receive or transmit. Only the LO (local oscillator) terminal is singular in that the LO is maintained for either receive or transmit states. The specific type of mixer you use does not make much difference as long as it will work at the frequency of interest. Most mixers are good to 500 MHz and some to just over 2,000 MHz, then stripline or spe-

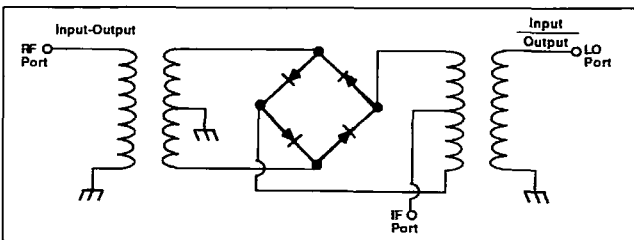


Figure 1. Basic double-balanced mixer (DBM) wound on two toroid cores, usually ferrite.

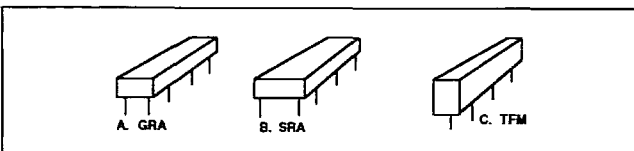


Figure 2. Typical case styles. Style "B," the larger unit, is popular with the SBL and SRA mixer types. Style "C" is typical for TFM types.

cial construction type mixers take over.

10 GHz Mixers/Applications

The easiest mixer for microwave use is the 3 dB hybrid mixer. See Figure 3. This is the mixer that is used on my 10 GHz system. It can be easily reproduced in larger scale for other lower microwave frequencies and is very forgiving of construction errors. The local oscillator injection is on 10.223 MHz and uses an IF frequency of 145 MHz (a 2 meter SSB HT) for receive and transmit.

On the mixer RF port, coaxial relays are used to switch preamp direction to change from receive to transmit. In this way only one low-noise amplifier is needed for normal receive and then it serves as a gain block in the transmit direction to boost the output from the mixer to a higher level. In my application, I use the amplifier to

drive a 10 watt TWT (traveling wave tube) to full output power. A TWT requires about +2 dBm drive power and has about 40 dB gain. For reference: 0 dBm = 1 mW, +20 dBm = 100 mW, +30 dBm = 1W and +40 dBm = 10 watts.

To construct a converter for any frequency, all you need is a mixer and local oscillator source, and an I-F amplifier. The frills for transceiver and filtering can be added later as the converter progresses. All stages in the mythical converter can be individual circuit blocks made up of surplus or salvaged components (gain blocks/mixer blocks) and hooking them together in a coaxial connection. It's really quite easy. If you don't believe this, look inside any high quality spectrum analyzer or microwave test set as this is basically the approach they take.

The same is true in my 10 GHz station. The mixer used was surplus and

a bare-bones 3 dB hybrid type. It was enclosed in a box fashioned out of 1/2"-wide brass strips. Again, SMA coaxial connectors were soldered to the appropriate ports on the PC board for the RF, LO, and IF connections. See Figure 4 for a description of this type of mixer construction. This surplus mixer was intended for use at 12 GHz with an IF of 1.4 GHz. We had to modify the IF port to make it usable at 145 MHz. This was accomplished by cutting dead the 1.4 GHz RFC (stripline) and replacing it with small wire-wound RF chokes resonant at 145 MHz.

Recently, during the ARRL 1992 10 GHz contest, I took this same mixer, using it in my 10 GHz system. Operation on the last weekend was mobile 10 GHz SSB with my partner N6LW. Both of us operated 10 GHz mobile in motion along the coast road from San Diego towards Los Angeles. We used the waveguide slot omni antennas described in this column some time ago. This omnidirectional antenna made mobile operation possible. The omni performed well, giving about 10 dB nominal gain.

How was operation? Well, we both logged about 27 SSB contacts from Kerry N6LW's truck. The

rigs we used were placed in boxes in the bed of the truck and they had to be modified for mobile operation. We had been using toggle switches to transfer relay-controlled circuit functions from receive to transmit.

The circuit was modified by constructing an RF actuated relay circuit that would do the required switching in the 10 GHz converter when we pushed the PTT on our 2 meter HTs in the cab of the truck. In this configuration, the 2 meter HTs act as a rec/xmit IF of our 10 GHz system. When we operated the PTT on the 2 meter HT, RF was detected in the truck bed detect circuit and it in turn operated a myriad of coaxial relays in the rear of the truck. This re-configured our equipment from receive and went to transmit, activating the TWT amplifier last. Quite a hunk of junk going on, but it performed flawlessly for the entire day's operation on both Kerry's and my system.

With the switching in good operation and planing operation using omnidirectional antennas several things had to be proved. As far as I know, mobile operation in motion has not been done before, at least with omnidirectional antennas. In actual use the antennas worked out quite well, as shown by the 27-some contacts we made. Of course, we took advantage of the terrain along the coast highway, making most paths over the water. However, many contacts were made over land paths and communication

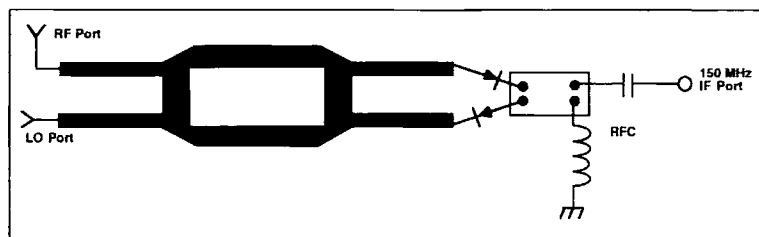


Figure 3. 10 GHz surplus hybrid (3 dBm) mixer, not to scale. The actual size is 3/4" square. All elements are constructed with 1/4-wavelength stripline. The IF port has a 1/4-wavelength stub acting as a short to 10 GHz and passing low frequency 2 meter IF.

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CIRCLE 246 ON READER SERVICE CARD

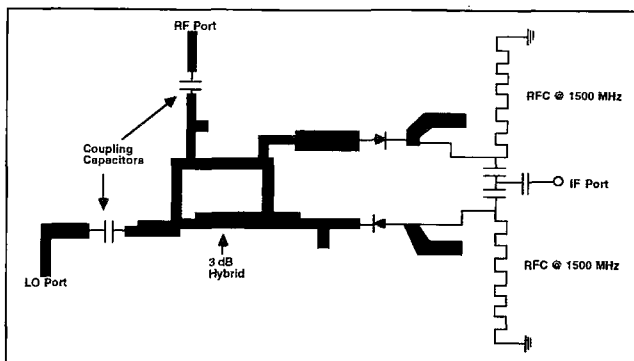


Figure 4. 12 GHz commercial mixer with 1500 MHz IF to modify the IF port for 150 MHz/2 meter IF. Cut out 1.56 GHz RFCs and replace with 2 meter RFC. RFC (choke) must be a miniature device the size of a 1/4-watt resistor as the PC board is 3/4" wide by 2" long.

was just great. When the Doppler shift became too great due to our motion and signals were strong, we shifted to FM narrowband operation with our HTs (a flick of the mode switch). FM worked quite well. As a matter of fact, in a few cases communications on 10 GHz was so good it was a vast improvement over simplex 2 meter communications.

We made no attempt to aim antennas, other than trying to locate a parking space or drive until signals peaked up to higher levels. On one stop temptation was rampant as the best signal strength was obtained when parking in front of a bakery. Normally, traveling from San Diego to Los Angeles is

done on freeways and little is noticed of the small coastal communities. But, since time was not important, we took the coast road and it proved to be an additional pleasure for a Sunday outing.

So much for our operation. The point I wanted to make is that our rigs worked well and they were constructed out of surplus components. You don't have to pay dearly for an expensive commercial unit, just watch the surplus sales and swap meets. What you want may be disguised as part of a much larger PC board. In our case, we had to cut the mixer out of a much larger PC board and attach connectors to it. It worked well. Keep your

eyes open and you too can possibly find some rare goodies in surplus.

International Microwave Operation, Denmark

I received another bit of information from Steen Gruby OZ9GI in Denmark. Steen sent the logs of operation from their group's (the North Zealand and Procom's Amateur Radio Club) activity. They operated on not only 10 GHz but 24 GHz and 47 GHz as well. Quite an accomplishment. In 1990 the best they did on 24 GHz was 227 km, set by OZ1UM and DB6NT, just 52 km off the world record for 24 GHz distance. This year they planned to work 47 GHz and from their notes never believed that they would equal or better their previous distances set on 10 GHz or even 24 GHz. However, DB6NT, DF9LN and DF2CA succeeded in carrying out a two-way SSB/CW QSO with OZ1UM. That equates to a contact on 47 GHz of 90 km, and a European record.

The equipment at DB6NT was a transceiver with 5 mW output and a noise figure of 15 dB. They used a 30

cm parabolic dish with a Cassegrain feed system. OZ1UM's transceiver had 100 microwatts and a similar noise figure, 15 dB. See Photo A. The antenna was a 25 cm Procom dish with an open waveguide feeding system, referred to as a "shepherd's crook." They all appear quite active and look like they are mounting a very serious effort towards breaking the world distance record of 104 km on 47 GHz. I have to add that they must have had a good source for components especially for 24 GHz and 47 GHz materials. Members of our microwave group here in San Diego are looking for materials for these frequencies as they are quite hard to obtain. You have to watch out for lots of those components that start with the "M" word ("microwave") that makes components expensive at swap meets and other gatherings.

Well, watch out for that "M" word. I hope you enjoy it as much as I do. As always, I will be glad to answer any questions concerning this or other related topics. Please enclose an SASE for a prompt reply.

73

TABLE 1. PORT IDENTIFICATION FOR DBMS.

Type	SRA	SRA	SRA	SBL	GRA
1-3	2-4	5-11-12	1-3	A11	
LO	8	8	8	1	
RF	1	3-4	1	1	6
IF	3-4	1	3	3-4	4
Ground	2-5-6-7	2-5-6-7	2-5-6-7	2-5-6-7	2-3-5

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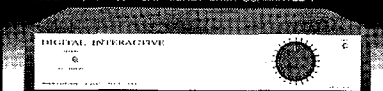
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73

CIRCLE 193 ON READER SERVICE CARD

Writing for 73

At least three or four times a week, somebody asks me about writing for 73. Since we are always on the lookout for good articles, for 73 and for our sister publication *Radio Fun*, I thought I'd use this space this month to give you all some pointers on getting published. I hope many of you will give it a try.

What to Write

This is the easy part. Any book on free-lance writing will tell you that the best way to know what kind of articles a particular publication is looking for is to read that publication. Not just one or two issues, either. You want to get intimately familiar with a magazine's style and content, so that means looking at recent back issues (the last year or two) and every new issue as it comes out (writers who use on a regular basis get free subscriptions—newcomers have to earn one). Reading current issues will keep you from writing about something we've already covered recently.

If you read 73 on a regular basis, you know that we mostly publish construction articles, other "how-to" type articles and product reviews. Product reviews are almost always assigned to writers who we've worked with for a while. Every once in awhile a product review will come in for some item that we hadn't thought of. If the product is relevant and the writing is good, we'll buy it. This is probably the toughest way to get published in 73, but it does happen on a regular basis. If you want to try a product review, stay away from the major manufacturers—or at least their main products. The latest 2 meter HTs and HF rigs are *always* reviewed by writers we know (in case you're wondering, yes... we do have to return the items to the manufacturers). Also, stick to products that have been introduced or upgraded within the last year. Things like antennas (especially beams or other "heavy iron"), testbench gear, electronic kits and gadgets from some of the smaller manufacturers are good products to think about. If you've recently bought something that you particularly like, study a few of our recent reviews, then go to it. You can make it as technical as your testbench and knowledge allows, or you can do a more informal "user review" (we publish both kinds, but tend to lean toward the more informal). One word of caution: Do *not* call a manufacturer and try to get a piece of free gear from them by telling them you're "writing for 73." All the manufacturers know (or at least they should) that equipment loaned for review is shipped to our editorial offices before going to the author, and all of our regular reviewers know that they should never call a manufacturer on their own.

The easiest way to get published in 73 is with a good "how-to" article. It could be anything—a construction article, a clever solution to a tough antenna installation, an article about how your club ran a successful membership drive or licensing class. If your article has to do with amateur radio and it shows others how to do something, you've already won half the

David Cassidy N1GPH

battle. The other half is the writing part.

How to Write

While I don't pretend to be the last word on good writing, I have read a lot of books on the subject by those who are. Writing well is not difficult. A few simple rules, if followed, will help anyone with an average education to write acceptable prose.

Rule Number One: Read! If you are not a reader, chances are you are also not much of a writer.

Rule Number Two: Do not try to write about something you are unfamiliar with. An editor can smell BS from across the room, and so can a reader. Write about what you know.

Rule Number Three: Do not use a big word when a small word explains your point just as well.

Rule Number Four: Do not use two words when one word will do.

Rule Number Five: Do not repeat yourself. Make your point, then move on.

Rule Number Six: Your article (story, novel, screenplay) should be exactly as long as it needs to be—not one word longer, not one word shorter.

Rule Number Seven: Get your facts straight. Not close enough. Not "it sounds right." Anything that you present as a fact must be 100%, no exceptions, accurate.

In magazine writing, you need to grab the reader in the first sentence or two. If you don't, he'll move on to the next page. Don't spend the first three paragraphs with a cute story about how you came up with your whiz-bang antenna. Explain the problem, propose the solution then get on with it. Also, don't get overly concerned with style and vocabulary (see Rule Three). Write as if you were writing a letter to a close friend.

One final thing... and this is the absolute most important thing for any new writer to get into his or her head right from the start. Are you ready? Here it is: All good writing is REwriting. Nobody—not your high school writing teacher, not Ernest Hemingway, not Walt Whitman, not Rachel Carson, not John Irving, not Alice Walker, not Stephen King—nobody writes so well that they don't need to rewrite. The first words on paper are just that—words on paper. The craft of writing is taking those words and making them say *exactly* what you want them to say, in the best way you can say it. If you haven't gone through at least two or three rewrites, you're not writing, you're just typing.

Be Nice to Editors

Despite what some professional writers might say, editors *do* have hearts and anything you do to make their job easier will make them all warm and fuzzy inside. The first thing is to reread the above paragraph about rewriting. A good editor (or even a bad one, for that matter) can tell a first draft before opening the envelope. You can't fool us, so don't try.

Other things you can do to make an editor think of you kindly all fall into the "common sense" and "common courtesy" arenas. Get yourself a good book on

Continued on page 72

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

As this is being written (mid-November) the solar flux that had been declining steadily for several months has turned around and increased to the 150s during the past three weeks or so, and the higher HF bands have been very good for DX. This happy situation, however, is likely to have returned to normal by the time you read this, and turned downward again. February is *not* expected to be a particularly good month for communications on the HF bands.

Look for a disturbance in the magnetic field on or about February 1st, with possibly very poor band conditions, perhaps even a DX "blackout." There is likely to be an even worse situation surrounding the 10th of February (give or take a day or so) which is likely to last for four or five days. HF bands are likely to be very upset again, and you might even find some very disturbed geophysical conditions, like heavy winter storms, and other effects on earth. Finally, a day or two surrounding the 21st is likely to exhibit very poor HF band conditions once again. Between these times (see chart) you will find Good-to-Fair band conditions—typical of February. On "Good" days there ought to be openings into Europe in the morning, to Africa at midday, and to the Pacific in the afternoon or early evening, on the bands between 20 and 10 meters. Although the higher bands like 10, 12, 15, and 17 meters may close by sunset, 20 meters should stay open until early evening hours. Short-skip will be available on most bands above 30 meters during daylight hours. On 30, 40, and 80/160 meters, you can expect late-afternoon-to-early-evening openings into Europe, with the lower bands becoming better and better as darkness overtakes all of the U.S.A. In the early mornings, expect openings into the Pacific on "Good" days. As always, 160 meters—are at night and poorest during the day because of high absorption of these lower frequencies.

The daily forecast can be followed for times of "Good," "Poor," or "Fair" band conditions. On "Fair" days there will be some propagation east and west, but more likely on north-south paths. On "Poor" days the HF bands

may exhibit polar path echo and garbling, with little or no propagation to Europe or the Pacific. There could be some trans-equatorial communication. There can be abrupt signal drop-out and much fast QSB or fading—even on decent signals. Use the band-time-direction chart to pick the best hours for DX on the various bands, modified by what you see on the daily forecast. WWW is your best friend for current information of Solar Flux and Magnetic Field indexes. Remember, the *higher the Solar Flux and the lower the Boulder K and A indexes, the better conditions will be for worldwide propagation.*

Let me know how these forecasts work out for you, and if more explanation of their use is needed. See you next month. Jim Gray W1XU.

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	-	-	-	-	-	-	-	-	-	-
ARGENTINA	22	45	40	42	-	-	20	23	15	17	20	17
AUSTRALIA	23	20	17	-	40	40	40	40	40	40	40	40
CANAL ZONE	20	20	20	20	20	20	20	20	20	20	20	20
ENGLAND	40	45	40	40	40	40	40	40	40	40	40	40
HAWAII	15	20	-	-	-	-	-	-	-	-	-	-
INDIA	15	20	-	-	-	-	-	-	-	-	-	-
JAPAN	15	20	-	-	-	-	-	-	-	-	-	-
MEXICO	20	20	20	20	20	20	20	20	20	20	20	20
PHILIPPINES	-	-	-	-	-	-	-	-	-	-	-	-
PUERTO RICO	20	20	20	20	20	20	20	20	20	20	20	20
SOUTH AFRICA	20	40	-	-	-	-	20	20	20	20	20	20
U.S.A.	-	-	-	-	-	-	-	-	-	-	-	-
WEST COAST	15	20	20	20	20	20	20	20	20	20	20	20

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	-	-	-	-	-	-	-	-	-	-
ARGENTINA	22	45	40	42	-	-	20	23	15	17	20	17
AUSTRALIA	23	20	17	-	40	40	40	40	40	40	40	40
CANAL ZONE	20	20	20	20	20	20	20	20	20	20	20	20
ENGLAND	40	45	40	40	40	40	40	40	40	40	40	40
HAWAII	15	20	-	-	-	-	-	-	-	-	-	-
INDIA	15	20	-	-	-	-	-	-	-	-	-	-
JAPAN	15	20	-	-	-	-	-	-	-	-	-	-
MEXICO	20	20	20	20	20	20	20	20	20	20	20	20
PHILIPPINES	-	-	-	-	-	-	-	-	-	-	-	-
PUERTO RICO	20	20	20	20	20	20	20	20	20	20	20	20
SOUTH AFRICA	20	40	-	-	-	-	20	20	20	20	20	20
U.S.A.	-	-	-	-	-	-	-	-	-	-	-	-

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	-	-	-	-	-	-	-	-	-	-
ARGENTINA	22	45	40	42	-	-	20	23	15	17	20	17
AUSTRALIA	23	20	17	-	40	40	40	40	40	40	40	40
CANAL ZONE	20	20	20	20	20	20	20	20	20	20	20	20
ENGLAND	40	45	40	40	40	40	40	40	40	40	40	40
HAWAII	15	20	-	-	-	-	-	-	-	-	-	-
INDIA	15	20	-	-	-	-	-	-	-	-	-	-
JAPAN	15	20	-	-	-	-	-	-	-	-	-	-
MEXICO	20	20	20	20	20	20	20	20	20	20	20	20
PHILIPPINES	-	-	-	-	-	-	-	-	-	-	-	-
PUERTO RICO	20	20	20	20	20	20	20	20	20	20	20	20
SOUTH AFRICA	20	40	-	-	-	-	20	20	20	20	20	20
U.S.A.	-	-	-	-	-	-	-	-	-	-	-	-
EAST COAST	15	20	20	20	20	20	20	20	20	20	20	20

*Try 80 meters.

The bands shown represent the highest usable a these times on "Good Days."

Note that the lower frequency bands open first and close last.

FEBRUARY 1993

SUN	MON	TUE	WED	THU	FRI	SAT
	1 V-P	2 P-F	3 F-G	4 G	5 G	6 G-F
7 F-P	8 P	9 VP	10 VP	11 P	12 P	13 P-F
14 F-G	15 G-F	16 G-F	17 G-F	18 F-G	19 G-F	20 F-P
21 P	22 P	23 P-F	24 P-F	25 F	26 F	27 F-G
28 G						

*VP=Very Poor

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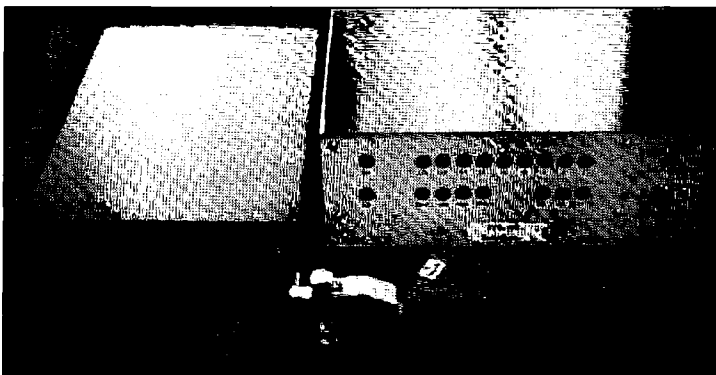
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Cover: Associate Publisher David Cassidy N1GPH shows his best side to the camera while operating rent-a-car mobile in St. Augustine, Florida. Photo by Kelly O'Dell.

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NEVER SAY DIE

Wayne Green W2NSD/1

Another Bummer

A letter from KH6COY mentioned the military being a supporter of amateur radio as a way to preserve frequencies for their use in time of war. Yep, that was one of the unstated benefits of amateur radio back when I was a whipper-snapper . . . back when I still had more hair on my head than on my chest. Well, both war and technology have changed so, far's I can see, this is just another relic of the past.

Sure, when WWII came along and we got whopped at Pearl Harbor, we had to start almost from scratch and build an army and navy, complete with communications. Lordy, when I reported aboard my submarine in 1943 one of the two radios we depended on was still a 1920s-vintage TRF set. That's right, from before the super-heterodyne! And when I worked for a few months for G.E. in Schenectady (before joining the Navy) making portable transmitters for the Army, the design had been finalized in 1935. I couldn't believe how out-of-date the stuff was we were building. Apparently no one had made any plans for pursuing a war, so they had to go with whatever they'd been making several years earlier.

Roosevelt quivered with rage when the Japanese bombed Pearl Harbor. His rage should have been with his intelligence people and our military for being asleep, not the Japanese, who did exactly the right thing. They knocked us for a loop and quickly spread out all through key areas of Asia. The Japanese high command wanted to stop us up front, grab a bunch of badly wanted territory, and then sign a peace treaty which would let them hold everything they'd conquered. They misjudged our dudgeon. We then went ahead and gradually out-invented them in radar, out-produced them in weapons, and ground them down. The atomic bomb was just the capping high-tech blow.

In those days we needed the ham bands for military communications. Of course we had a couple years in which to invent and build our electronics and communications systems. War is completely different now. The Persian Gulf war lasted a few days, not four years. Communications systems for war use these days have to be integrated into weapons systems. They have to have been in operation for a long time so the bugs will have been worked out. Whatever radio frequen-

cies the military need today for any wars we can imagine are already in full use.

The military are in no more need of a bunch of ham bands than they are of a bunch of fat old men to draft as operators. In the 1940s our average age was in the low 30s, with 80% of all new hams being teenagers. This is why 80% of all licensed hams were drafted into the military during WWII. And we did indeed make a big difference. I joined the Navy in 1942 and breezed through their electronics school in nine months, emerging as a radio, radar and sonar expert. I had the option of working in a research lab in Washington or going to sea. I chose submarines and as a result had a bunch of exciting adventures.

Today's communications equipment is completely packaged. The frequencies are built in, complete with the security systems. We don't need operators to copy CW anymore. We don't even need technicians to repair broken equipment in the field. If it breaks, a module is substituted or else the whole unit is replaced. How many hams do you know who service their solid-state synthesized rigs when they go blooey? We send 'em back for factory service.

The military have no use these days for hams for anything. They don't even need our bands anymore.

There's a great controversy over what role our military should be geared to play in the future. Are we going to let our media suck us into one adventure after another on the basis of our heart strings being pulled? Is this what we want to spend



a good part of our tax money doing?

We're in Somalia now. The pressure is on to get into the Serbian mess. Hussein and the Kurds are at it again. Then we'll be worrying about the extermination of zillions in southern Sudan. And further killing in Ethiopia. We're already faced with a growing interest by Muslim fundamentalists in killing us infidels in around 50 countries. I loved it when the Somalis we were trying to save from starvation stoned us for being Christians. Our media can have a ball getting us involved in endless messes. Maybe we should go into India and pacify the Muslims and Hindus, who've been killing each other for generations. How about the terrible mess in Burma, which I've visited and seen first hand? And the genocide in Timor? Sri Lanka? Chad? What about the native Fijians who want to kill the Indians? The Azerbaijanians want to kill the Armenians and vice versa. How soon can we get Tom Brokaw into the breach?

Now that we've beat communism, all that's left is to whip the rest of the world into submission. But the one thing we're not going to need is any of our ham bands.

What's Cooking?

If you want to live to be 70 and take advantage of the free skiing us septuagenarians enjoy, not to mention getting those full Social Security payments, even if you're still working, you're going to want to have stopped smoking early on, taken it easy on the beer, and kept your weight down. The next time you're wandering around at the Dayton Hamvention, just take a

look at how many tons of hamfat you see waddling around. Tsk.

There are plenty of great things you can cook which will help keep your weight down, things which you can whip up in minutes. For instance, there's Uncle Wayne's Onion Slumgullion, which I guarantee you'll love. And it only takes maybe 10 minutes from start to finish.

You dice up a 3" onion, slice a quarter cabbage into quarter-inch strips, quarter a 1" chunk of Polish Kielbasa and then cut the quarters into 1/8" slices. You're almost done. You put all this into a large frying pan with some bacon fat to keep it from sticking, turning it to prevent burning.

While that's cooking, bring two cups of water to a boil in a small saucepan. Add a crunched up package of ramen noodles and cook for three minutes. Strain the noodles to get rid of the water and add the little package of flavoring. By now your onion and cabbage mix should be done. Turn off the fire, mix in the noodles and serve.

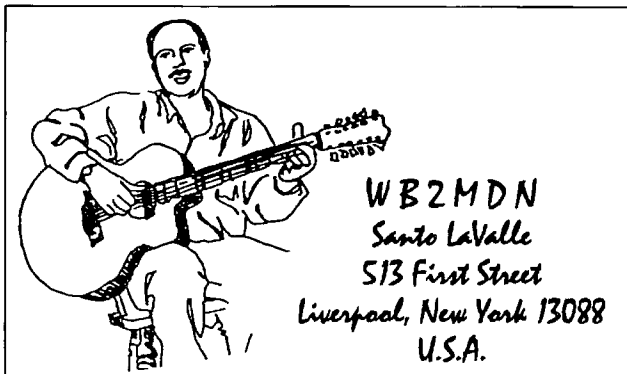
I add salt while I'm cooking, plus plenty of black pepper. You can try it bland, but then give it a try with a heavy pepper hand. Vegetarians can leave out the pieces of sausage. The above makes enough to feed two for a fast dinner. I often make up a double portion and put the leftovers into the fridge to be warmed up in the microwave oven. Tastes like fresh-made.

If you haven't been provident enough to make some homemade applesauce to go with the Onion Slumgullion, you can make some in about five minutes. Allow one medium apple per person and slice into a microwave dish, skin and all. You want to start with a tart apple, like a Baldwin, Cortland, Macintosh, Northern Spy, Transparent, or Duchess, and *not* one of those crummy bland Delicious. Quarter the apple, cut out the core (a grapefruit knife does this well), cut the quarters into four chunks so they'll cook fast. Add a handful of raisins, a couple tablespoons of Brownulated sugar and a half inch of water. Cook about three minutes in the microwave and you'll have a great companion for the Onion Slumgullion.

It's been awhile since I've given the recipe for Uncle Wayne's Hurry Curry, so keep after me and I'll write it up again. It's fast, fabulous, and diet food. Of course, if all you've ever learned to eat is hamburgers, then I can tell you how to make the best hamburger you've ever tasted, and fast too. I enjoy cooking, but I like things I can fix in a few minutes. Ask me about Uncle Green's Beans.

One more thing—how about a low calorie dessert? My favorite is sugar-free Jello with a bunch of fruit in it. The only calories are in the fruit. I prefer to use two large packages of orange Jello (130 calories) and mix in a can of water-packed sour cherries (save the juice, it's delicious to drink), a can of crushed pineapple, and a can of free-stone peaches (cut into chunks). This make about four quarts of fruit Jello, which lasts me a couple weeks, a nice low-calorie dessert, even when served with a teaspoon of light cream on it.

Hmm, this is making me hungry.



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QSL of the Month To enter your QSL, mail it in an envelope to 73, Wayne Green Inc., 70 Route 202-N, Peterborough, NH 03458. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to 73. Entries not in envelopes cannot be accepted.

From The Hamshack

Michael A. Moore N7RY, Estacada OR Wayne, I see you are searching for comments on the "Dream Station" (November 1992 issue) and I can't resist making a comment or two. For my money, the ICOM 765 transceiver would make a real start on your station. It runs AM/SSB/CW/FSK with over 100 watts out and stays cool doing it. It has quite a few switches and buttons, though fewer than some other current HF offerings, and most of them you can happily ignore. I am not sure if you run much RTTY these days, but if you were going to, the "real" FSK done with a digital synthesizer is light-years ahead of feeding audio to the SSB input.

Now CLOVER is coming out, and we will be back to audio tones into the SSB again, but the 765 is about as clean on SSB as you can find, so it would handle it. It has a nice speech compressor that is clean for SSB as well. Let's not leave out CW—it runs full break-in and has a built-in iambic keyer. You just plug your Bencher or whatever in and you're set.

I have run RTTY and CW contests with the 765, and if I had more time/better antennas I think I could get some real wallpaper!

There are times when 100 watts won't do, so I guess one should have a decent amplifier. I personally like amplifiers that are suited for RTTY use; too few are these days. May I recommend the Ten-Tec Titan or Bill Henry's 3K? (I know Dick Ehrhorn's devices are solidly built but at last glance his units were priced a bit higher.) The Titan will handle key-down RTTY for contesting, and is probably overkill for SSB and CW, but I hate smelling/inhaling smoke in my shack, and I assume you value your lungs equally highly.

My favorite amplifier is a homebrew pair of 4-400s that my father Art K8LXF and I put together 30 years ago, with a huge plate transformer and silver-plated coils, the latter mostly for looks. It has 3/8" solid silver contacts on the coil switches, and has lasted many hours of RTTY FSK. If I cannot work a station with that, it is seldom worth turning the Titan on to try any further until propagation shifts.

Towers are another hassle. The easiest to put up these days are the aluminum towers by Glen Martin Engineering, with a HAZER trolley on them. I use his trolley on 50 feet of Rohn 25G to play with different antennas. If money were no object, the Telrex steel poles that turn would be the ticket for the lower part of the sunspot cycle coming up, but that is not in keeping with Yankee frugality.

Of course, if you want to be up 100 feet or so, it is best to stick with guyed Rohn 45G. (Ken K6SAD has put up 120 feet of 45G by his lone-

some self, which I don't advise but offer by way of astonishment.)

I have heard good reports from the KLM beams, but stacked Hy-Gains or Mosleys will outdo even those. If your locale has high winds, as we do here, I favor Telrex beams as they will take ice-rains that thicken the elements several inches without falling in the wind/rain.

Don't forget a quad of phased verticals (or at least one vertical) for the low bands—40, 80 and 160m will have some good times ahead. I have heard some of the more interesting rag-chews on 160m in recent times.

Enough soapboxing; keep up the good fight, and tell it like you see it. Amateur radio needs a dose of Green jalapeños from time to time.

Chuck Reik N8WDH, Garden City MI I would like to comment on the article by John Rehak N6HI reviewing iambic keyer paddles, which appeared in the December 1992 issue of 73. I found this article to be extremely interesting and informative.

I would like to offer a suggestion that would be of benefit to those of us who are aficionados of the straight key: Perhaps a similar article might be possible. I have no idea what percentage of your readership is of the same bent as I, but I would think that there must be a few of us. Apparently, there are enough of us to warrant making straight keys in quite a variety.

Walter E. Taylor K4VI, Charlottesville VA Wayne, I just read your NSD column in the December 1992 issue of 73 Magazine.

Your remarks about the rainfall in Ketchikan, Alaska, prompted this reply to you. You were not even close to giving the correct value of the amount of rainfall in other places of the world and the US. Look up the weather records for the interior of Kauai in the Hawaiian Islands. They have averaged over 500 inches of rain a year for many decades. There is a rain forest in India/Pakistan that averages more than 530 inches a year. Both of these places make Ketchikan seem like a desert.

Morris Bleckman N9GVA, Lincolnwood IL I just received my January 1993 issue of 73 and I think you have forgotten me. I am not a builder of radio equipment, I am an operator. I admit I got into ham radio about five years ago without any background in electronics. At this time I operate my ICOM 751A, complete with a 55-foot tube tower (I dug the hole and poured the concrete) and a KT34a tribander, plus a G5RV and an R7 vertical after the HF6V blew down in an ice storm. I also have a 735 on my 40-foot sailboat. All of this was installed by yours truly. And it all works. I even know

what end of an iron gets hot BUT I don't build. I welcome articles that discuss problems of equipment and the uses of same.

Again, I am an operator and user of equipment. I want to know more about the uses of test equipment and how to use it. I want to hear about the pros and cons of equipment. I want to know about the differences and how to use them to my advantage. Gordon West WB6NOA was of great help when I installed a 735 in my boat. I phoned Mr. West on a couple of occasions with a tech question concerning mobile installation and he was always helpful. Ditto for Bob Hell about his speakers. Got the idea? I am not into schematics.

Wayne, I enjoy your editorials. I, too, am a WWII USNR type, from 12/07/41 to 12/18/45, most of it as a photomate 1st Class with flight pay in an interpretation outfit. I, too, was a newsreel cameraman for CBS station WBBM TV, and I, too, left the camera and with a partner ended up with the largest 16 mm film processing lab in Chicago. When I sold it to my employees, it was 100% video.

There isn't any way I am going to send \$ for your ranting and raving. YOU ARE SUFFERING FROM TERMINAL SANITY. I know the symptoms.

Morris—I agree! I'd love to see more articles on the topics you describe. In fact, why don't you take a crack at writing some!

As for the charge of running so many construction articles, we plead guilty as charged. Our reader feedback cards always, without exception, list construction articles as the number one topic our readers would like to see more of—and we already publish twice what the other ham magazines do . . . David N1GPH

William A. Scherr, Jericho VT Wayne, I thought your piece on RF health hazards was simplistic while trying not to seem so. I use a window mount, Radio Shack telescoping or field-expedient antenna to transmit. I'm still waiting for my ticket, but I am an RTO for my National Guard unit. They told me all about RF radiation in Basic. Short rubber duckies aren't any good, period.

I enjoyed the piece on the micro-mag antenna, but my XYL still won't let me put one on her jeep.

I like your attitude; keep it up.

Arnold Samuels KH6COY, Ocean Shores WA Wayne, while I agree with you 99.999% of the time, I must take exception with you on something. Oh, I know we can't teach the old farts anything new. I do feel, however, that we have to make a start to teach the new generation of hams that ham radio is not an entitlement program. I know we have lost our value to society, but it doesn't have to be that way. I also know that you are aware of the fact that if it were not for the military needing these frequencies in case of an emergency and considering our

bands as a contingency we would have lost them a long time ago. I used to sit on CINCPAC's frequency coordinating committee in Honolulu back in the '60s and I know what's in their minds.

I am an old Stuyvesant graduate, and we had a ham station (WB2CLE). I went back for a reunion last June. Yes, you guessed it—no more ham station. It is sad how ham radio has gone down, just like the rest of our educational system. When I started with the Voice of America, about 90% of the engineers were hams. We all had to have 1st class licenses, etc. Not anymore. You are right—ham radio went downhill with incentive licensing. Do you think we can ever turn this thing around?

Now something for 73's readers. I just completed computerizing all my old logbooks. What a job! I operated from Wake Island from 1962 to 1966 as KH6COY and KW6DS. I still have a handful of KW6DS cards. If there are any collectors out there who made contact with me and need a card I would gladly oblige if I can verify it. Send a self-addressed, stamped envelope.

T. C., Victoria, Australia As an avid reader of your magazine, I certainly enjoy the up-to-date articles you have. Apart from being economical to build and in the original spirit of build-it-yourself amateur radio, they are also of great educational value. I only wish your distributors did an even better job as I seem to have recent difficulties in receiving my copies. One further problem is that you guys seem to take a long time to get things right—two corrections to the PMP and still mistakes.

One tip to PMP builders which I discovered the hard way was the way pins 6 and 8 were tied together on the original circuit board. It won't work! Pin 6 on the TCM chip has a divided clock output which stops pin 8 from talking to the computer. My suggestion is that you guys ought to set up a lab of your own like the ARRL and duplicate circuits submitted to filter out potential errors like this. You would make life a lot easier for your readers.

Anyway, after all this grumble, as my subscription is due in July 1993, I wonder if you would be so kind as to reward my loyalty with a year's free subscription. After all, our diminishing currency versus yours is gradually making your journal out of reach.

T. C.—We're currently negotiating with a new distributor in your part of the world, so hopefully things will get better soon.

Thanks for the corrections to PMP. We're a small outfit here and we simply can't afford the expense of a testing lab. We rely on our authors to make sure their stuff is clean, and we rely on our readers to tell us when we screw up.

Nice try on the free subscription. Unsuccessful try, but nice . . . David N1GPH.

Packet Radio Equipment Needed for Poland Center

Packet radio equipment is needed for "Community-Based Computer Centers" in Poland. The first center was opened recently with a network of five new computers, two printers, a fax/modem, and other peripherals, through the efforts of the American Council for Polish Culture (ACPC) and the support of the Institute for Community-Based Computing (ICBC) of New Durham, New Hampshire. The center, located in Siedlce, an economically depressed region of Poland, is opening up opportunities for young adults, including the disabled, to study and work with state-of-the-art computer equipment and key programs, particularly desktop publishing. While all of the equipment installed at the center has been donated or purchased through the ACPC and ICBC, the community itself is providing the space, utilities and manpower to operate and maintain the center. During 1993, the ACPC and ICBC plan to replicate the Siedlce center in three other communities in Poland.

The U.S. State Department has suggested that the center training opportunities and operations could be further enhanced by improved communications with other parts of the country through the introduction of packet operations. The ACPC, a 501(c)(3) nonprofit organization, is appealing for donations of packet radio components (radios, controllers, antennas, etc.), new or used, for the installation of one complete unit at the Siedlce Center and a unit in each of the three additional centers planned for 1993. Anyone interested in helping by donating equipment is requested to contact: Mr. Marion Winters, ACPC Computers for Poland Project Director, 953 Wellington Road, Rindge NH 03461; telephone (603) 899-6333.

FCC Issues 222 MHz and 23 Cm Proposal

The FCC has proposed several changes in the 222 and 1240 MHz amateur bands. The first would establish a small new subband in the 222 MHz band where repeater stations would be prohibited, in order to enhance weak-signal communications and experimentation.

The second proposal would allow Novice class licensees access to the entire 222-225 MHz amateur band.

The third proposal would allow Novice class operators to be licensees and control operators of repeaters in the 222-225 MHz band and in the 1270-1295 MHz Novice subband of the 1240-1300 MHz band.

The "weak signal" proposal was made by the ARRL in November 1991, following the reassignment of 220-222 MHz to commercial interests. The League suggested a 150 kHz subband at 222.00-222.15 MHz for such weak signal work.

The ARRL at that time also requested expansion of Novice operating privileges to include the entire 222 MHz band, in order to establish a common meeting ground where Novices could sample other modes of amateur operation in addition to repeaters.

The proposed changes in Novice repeater license and control operator privileges, which the ARRL did not seek, came as the result of petitioner Michael C. Trahos KB4PGC, who argued that the Amateur Service should follow the General Mobile Radio Service and the Private Land Mobile Radio Services, where user licensees may also be licensees of repeaters without being required to pass any additional examination. The ARRL has not as yet adopted a position on this proposal.

The Commission said it believed there was merit in the petitions of both the ARRL and Trahos, and has asked for comments on the proposed rule changes in P.R. Docket 92-289. No deadline has as yet been set for those comments. *TNX ARRL; Westlink Report #640, December 24, 1992.*

Rescue at Sea

An Illinois ham operator helped to rescue a pair of British yachtsman trapped in a floundering sailboat sinking some five hundred miles off the Florida coast. Former Air Force radio technician Wilbur Warke N9RGE heard the distress call from the sailboat *Que Tal* while killing time before leaving for work on December 7, 1992.

According to Warke, he was monitoring the bands when he happened across a voice with an English accent asking for emergency assistance. Warke was able to get a location on the sinking boat. He relayed that to the Coast Guard, which in turn arranged for the Norwegian tanker *Team Trinta* to go to the sailors' aid.

Shortly before 4:00 p.m. local time, the Coast Guard called back to Warke to let him know that the tanker had the *Que Tal* in sight. A short while later the sailors were rescued and taken on board the *Team Trinta* just before the *Que Tal* sank. The two English sailors were identified as Nicholas Kyriacou and John Briffa. They had set sail from North Carolina on November 2nd with their destination being Aruba. *TNX AAØCR; Associated Press; ARRL; Westlink Report #640, December 24, 1992.*

QCWA Scholars Awarded \$7,200 in Nine Memorial Scholarships

Nine 1992 QCWA scholarships—totaling \$7,200—have been awarded to students from nine different states. (Applications were received from 49 states this year!)

These educational grants are made each year from interest earned on the QCWA Scholarship Fund, established in memory of their Silent Keys. A total of 14 \$800 scholarships will be awarded in 1993.

This year's winners are:

Melissa L. Benish N3FAC, Pittston, PA, will be a junior at Penn State, studying mechanical engineering;

Elena Doerrie KB5DAK, Booker, TX, will be a freshman at Johnson Whales University, studying public relations;

Lesley Goh KD4IPS, Somerville, MA, in her final year working towards a BS degree in computer engineering at the University of Florida;

Martin H. Gruen KA2VLD, Margate, FL, a junior at Stetson University, majoring in biology;

Dustin W. Howell N5ZVY, Minden, LA, studying for two degrees—first a BS in aviation science, then an Associate degree in criminal justice;

Shelly L. Jones KE5DX, Harrison, AR, will be a senior at Southwest Missouri State University, majoring in mathematics;

Diane R. Magen KG5CS, Grand Forks, ND, will be a junior at the University of North Dakota, majoring in aeronautical studies;

Andrew M. Ross KC6OHS, San Diego, CA, will be a freshman at Harvey Mudd University, studying applied mathematics; and

Rebecca Schoenberg, South Toms River, NJ, plans to major in Biology at Tufts University.

ARRL Files on Proposed Business Rules Change

The ARRL has filed formal reply comments to support an FCC proposal to revise the rules on permissible communications by amateurs. The League said that other commenters seeking fine-tuning of the new rules were asking for an unnecessary rigidity in amateur rules. But the ARRL argued against a request by commercial interests to relax the restriction on the use of amateur radio in ordinary news gathering—a request the Commission had previously denied.

The League had informally submitted a proposal for a change in the rules to the Commission on January 6th, 1992, a change that would restate certain sections of Part 97.113 in order to enable amateurs to continue, unfettered, to perform public service work. The League had not submitted a formal proposal for rule making in the matter. The FCC in April assigned the proposal RM-7895, in P.R. Docket 92-136.

In its reply comments filed December 1st, the League said that trying to be specific in a "content regulation" such as Section 97.113 was impossible. Yet the League agreed that some regulatory guidance would be needed. For example, in the case of amateurs providing communications for events held on a regular basis, the League suggested that weekly events should be considered "regular" and therefore not suitable for amateur support. Yet, annual events would be held seldom enough that amateurs could be the best providers of communications.

The League noted that the National Association of Broadcasters (NAB) and the Radio-Television News Director's Association (RTNDA) were jointly seeking once again to relax the restrictions against the use of amateur radio in day-to-day news gathering, despite having been twice turned down by the Commission on that very subject. The League cited comments from an NAB member and former RTNDA board member who called the plan "self-serving" on the part of the broadcasters and pointed out dangers in amateurs being used regularly as news gatherers.

The League requested that the FCC finalize its proposed restated rule as soon as possible. *TNX Westlink Report #640, December 24, 1992.*

Constructing High Current Power Supplies

Practical considerations, learned through experience.

by David A. Nordquest KE9ED

Much amateur equipment requires out-board DC, so the most useful accessory in the ham shack is probably the regulated, high current 13.8 volt power supply. In building such supplies, back issues of ham magazines, handbooks, manufacturers' data books, and technically-minded friends can give valuable assistance. Unfortunately, some things have to be learned—or relearned—in the laboratory of the School of Hard Knocks. Here are a few of the practical lessons I learned while building a 30 amp, 723-based supply.

Transformers

Transformers take up the most room in linear supplies, and they differ greatly in shape and size, so your whole layout should be planned around one. Selecting a unit can be a problem. Most hamfest specials appear to be unmarked. If you can determine the open circuit voltage, choose a unit whose voltage rating is about 25% to 33% higher than your desired figure under load. This is a rough approximation only; the proper value will depend on the construction of the transformer.

The handbooks give formulas for estimating transformer current capacity from the cross-sectional area of the windings. A very rough estimate can also be made by observing the wire size. Still, I learned that it is a good idea to put a load on unmarked transformers before going too far in the construction. The sag from a no-load to a load condition varies greatly. I had to abandon my first construction attempt because an old battery charger transformer slumped too much. Unfortunately, my new transformer turned out to be too large for the old chassis.

To check for capacity and voltage sag, I loaded transformers with various high wattage, low ohmage resistors. By taking current and voltage readings for different loads I was able to plot enough points on a transformer load line to estimate the hypothetical short circuit current at zero voltage. A transformer is probably good for 10% or 15% of the estimated zero voltage current. Luckily, my final transformer, a Basler, came with the manufacturer's test report.

Just what voltage is needed at the transformer's secondary depends on many fac-

tors: on whether a half-wave, full-wave, or bridge circuit is used; on filter capacitor size; on drops in the rectifiers, pass transistors (about a volt each) and emitter resistors; and on the sag in the transformer. A lower voltage secondary can be used if a separate winding (as in commercial supplies) or a separate small transformer (more practical for the amateur) is used to provide the extra 3 or 4 volts of elbowroom the regulator chip needs. This will save on heat dissipation in the pass transistors. Although my transformer has an output high enough for the regulator, I breadboarded the separate trans-

mary windings, one of which had taps for input voltages from 100 to 127. Putting the 0-to-100 volt portion of winding one in series with the untapped 110 volt second winding brought me very close to the output I wanted, but just a bit low. Using that part of the first winding between the 100 and 127 volt taps in series with winding two took the transformer output to 19 volts, which rose to 26 or so after the filter, with no load. That was a bit high, but still quite acceptable.

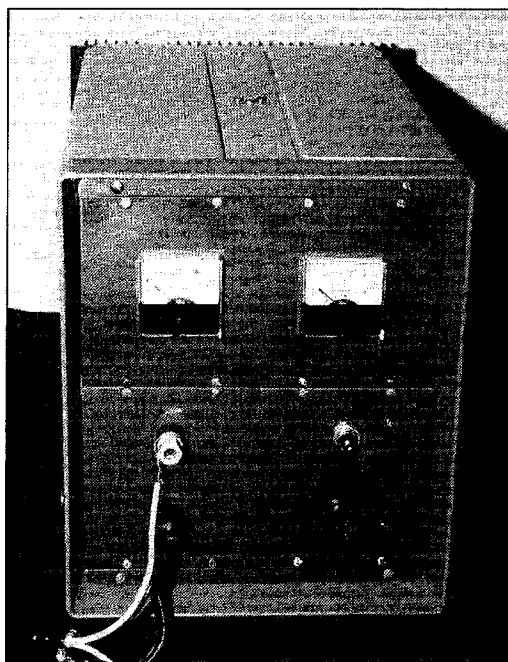
I was pleasantly surprised by the versatility of transformers with dual primaries and multiple taps. For example, if I want to change my 13.8 volt supply to 24 or 28 volts, I can simply reconnect the AC input to the proper transformer primary taps and adjust the regulator pot. (This assumes that other components are suitably rated.) I picked up two smaller units like this for future projects, because they're so useful.

Construction

Once I found my transformer I looked for a larger case. Eventually I cut down one from an obsolete piece of test equipment and replaced the front panels with thick, double-sided circuit board material. Because the frames of some of these cases are drilled and tapped, it is very easy to remove panels for servicing, meter adjustments, etc. The heavy plastic end pieces on this particular chassis provided a convenient location for mounting the pass transistor heat sink. Since the whole heat sink is insulated from ground, the transistors require no mica insulators, which simplifies mounting and slightly improves heat conduction.

I used some surplus GE 100 or 125 amp diodes to construct my full-wave bridge. Unless you get two diodes with reversed anodes and cathodes, be prepared to saw heat-sink material and to insulate the three required rectifier heat sinks (two single and one double) from each other, as well as from the chassis. If the proper mounting hardware is available all the diodes can be insulated and installed on a single heat sink, but a bridge module is an easier solution. I recently saw a 100 amp model at a hamfest for \$4, new.

It is a good idea to put bypass capacitors



former technique and it worked well.

After my first transformer failed to pass muster or supply sufficient current, a friend's donation of a beautiful new 24 volt 32 amp model brought new puzzles. At the output of the filter the voltage rose to about 34 volts, which was too high for the filter caps I had then and for the number of pass transistors I wanted to use. I considered using another transformer to buck the voltage, but found the amount of iron required to be excessive. I experimented with the two pri-

across the diodes when installing your rectifiers. After my supply was up and running I noticed a strange buzzing noise on an AM radio when I turned the supply on. Holding a capacitor across one diode (carefully!) reduced the noise. Bypassing them all with 0.01 μF ceramic disc caps made the noise vanish. Do this first—that's easier!

Computer-grade filter capacitors are very expensive new, but are readily available for a dollar or two each at hamfests. I eventually found two 67,000 μF , 75 volt units for my supply. The handbooks have formulas for calculating the capacitance needed, according to transformer voltage, voltage and current needed by the load, and type of rectifier used. The 2,000 μF per amp value sometimes recommended as a starting point is only a rough guess. My 134,000 μF value is high, but my diodes are husky enough to withstand the tremendous surges during the microseconds of each cycle when their output voltage is higher than the capacitors—the only time they can conduct.

For the regulator circuit, I chose the 723 chip for its excellent regulation, current limiting, and remote sense capability. Many designs have been published for this chip, but a couple of my "experiences" (the name we give to our mistakes) may be of interest. Avoid too much gain or too little gain in the drivers between the regulator and the pass transistors. Too little gain will make the 723 over-exert itself; too much may make the circuit highly sensitive and subject to microphonics. Initially, I had the 723 driving a 2N5339, which drove a high-gain MJ4035 Darlington, which drove the pass transistors. The drive current from the 723 was so low it was almost unreadable and the supply output was jittery. Eliminating the 2N5339 solved the problem and the 723 still loafed along with a drive current of 100 microamps at a 2 amp supply output. To ensure stability, I put a 2.7k resistor between the 723 output and ground to maintain a more reasonable and constant load.

Builders who want to avoid the hassle of making their own regulator board may want to try a trick suggested to me by Rick WA3MKT. You can purchase a relatively inexpensive low current, 723-based supply

with remote sensing and use the output to drive your pass transistors. If you hook the remote sensing terminals to the main supply output, the small supply will regulate the main one. Although I did not use this technique in my supply, I breadboarded it and it worked well.

If you make your own regulator board, be sure to include a good ground and to run both ends of the divider network (which sets the voltage output) directly to the supply output terminals or to the load. I did not do either at first and my regulation was poor at higher current levels.

Some references emphasize the desirability of using pass transistors of the same designation and lot number. I obtained several 2N3771s, which are much huskier than 2N3055s, and took care to select all from the same lot. I found the gains varied from the mid-teens to about a hundred. Perhaps different lot numbers or even just similar transistors (such as 2N3771s and 2N3772s) with closer gain figures would be as good or better. If you use mixed transistors you will have to design based on the weakest specs. However, gain differences within types are relatively unimportant because they can be swamped by using 0.1 ohm emitter balancing resistors.

Whatever pass transistors are used, their ratings mean little unless they are cooled by an adequate heat sink. Calculating the surface area needed is not at all simple, as the formulas in the handbooks and regulator data books will show. Because amateur-built supplies, like mine, will likely use non-custom transformers, the pass transistors will probably have much more heat to dissipate than in commercial supplies. The number or capacity of the pass transistors and the size of the heat sink should be correspondingly greater than in such commercial units.

Wiring high current supplies is no trivial matter. To avoid unwanted voltage drops, I used two runs of #10 stranded wire, purchased from an electrical supply company, for all heavy current runs. The great advantage of using stranded wire is that it bends more easily, but it is also more difficult to solder to terminal lugs. I took care of that problem by making liberal use of crimp-on

ring terminals, which I soldered to the wires for safety.

Some of my terminal lugs had several wires running to them. The positive output jack had two heavy wires from the current limit resistor, one wire from the regulator voltage-setting divider, one from the over-voltage protection circuit, one from the output capacitor, and one from the voltage meter. It would be difficult to solder all those wires properly to the output jack. I terminated them all with ring terminals and made a heavy copper extension for the jack, with a machine screw attached to accept half of the wires. Where I needed wires insulated from each other I used machine screws isolated by bare circuit board material.

With the heavy wire runs I used and with a substantial current resistor already breaking the positive output path, I had no desire to add another break for an amp meter shunt resistor. Instead, I configured a meter as a 1 volt voltmeter and had it read the voltage across the current limit resistor already in place. By playing around with values I was able to get the voltage figure indicated on the meter to correspond to the actual output current. Because the current limit resistor is so low in value (about 0.025 ohms in this supply) the connection between the meter leads and the resistor terminals should be flawless. When mine was not, I read 4 to 8 amps, rather than the 2 a car taillight was actually drawing. Concerning the output voltage meter, almost any sensitivity will do, if the proper series resistance is calculated.

The relatively simple schematics for regulated, high-current supplies may make them appear like easy and inexpensive weekend projects. Inexpensive they can be, with good shopping and the help of good friends. However, when you add in the tuition charges in the School of Hard Knocks, the opportunity costs do not look so trivial. Nor are home-built supplies likely to be as efficient as commercial units unless a custom transformer is available. Still, I've ended up with an excellent supply and will find my next supply project, and any needed repairs, much easier now—especially if some other alumni of the School will report some of the lessons they had to learn.

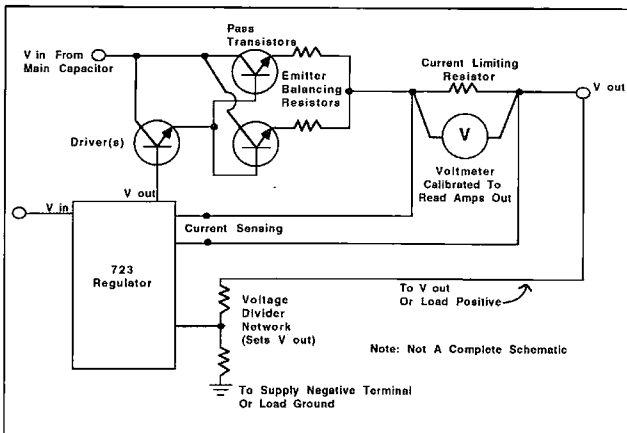


Figure 1. 723 circuit components.

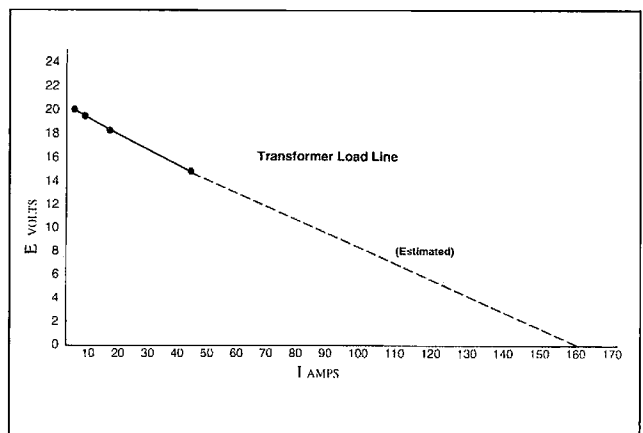


Figure 2. Transformer load line.

Fiber Optics and Amateur Radio

Is fiber-optic technology in our future?

by Roald Steen AJØN/LA6US

Fiber optics is a segment of the communications industry which is evolving rapidly. While fiber optics is used chiefly for land and undersea communications cables, there are also uses for this technology in amateur radio.

One of the most interesting applications of fiber optics in amateur radio may be as a substitute for coaxial cables. As you know, coaxial cables are lossy. The longer the coaxial cable and the higher the operating frequency, the more the signal will be attenuated in a coaxial cable. The falling cost of fiber-optic receivers and transmitters makes fiber optics an attractive substitute for coaxial cables.

We are used to having the receiver and the transmitter in the shack, but the correct location for these devices is really right next to the antenna. Through fiber optics, it is possible to select these favorable locations for the transmitter and the receiver.

The equipment in your shack could produce both the frequency and the modulation of the signal which you are transmitting. Once these two components of your signal are generated in the shack, they can be fed from a fiber-optic transmitter through a fiber-optic cable to the antenna, where an RF amplifier could be mounted in a weatherproof enclosure.

Both the fiber and the electric power to the transmitter must run up to the antenna. This can be achieved, in the case of a solid-state transmitter, simply by supplying the 12 volts DC, needed to operate the transmitter, through low voltage wiring.

Also, for the receiver front end, the best location is as close to the antenna as possible in order to avoid attenuation of the received signal and pickup of noise. Coaxial

cables pick up some electronic noise. By running fiber-optic cable from the receiver front end to the receiver in your shack you eliminate all pickup of electromagnetic

been adopted by some mobile amateur radio manufacturers. Aviation and marine radio manufacturers are also adopting the fiber-optic cable as a link between the control head and the transceiver.

Fiber-optic cables can be used for a number of other control and communications purposes. For example, fiber-optic cables may be used to connect one or several remote receivers to a repeater.

A significant advantage of fiber optics over other communications cables is its enormous bandwidth. A bandwidth of gigacycles is possible. This bandwidth limitation is not a limitation inherent in the fiber itself, but rather in the input and output devices, i.e. the optic receivers and transmitters.

The technology of fiber-optic receivers and transmitters is steadily improving. Scientists working for a Japanese company recently fed information at a rate of 20 gigacycles through a fiber-optic cable exceeding 600 miles. This equals a capacity of around 3,000 television channels. Commercial devices are lacking such laboratory records, yet the capabilities of modern commercial fiber-optic systems can be impressive.

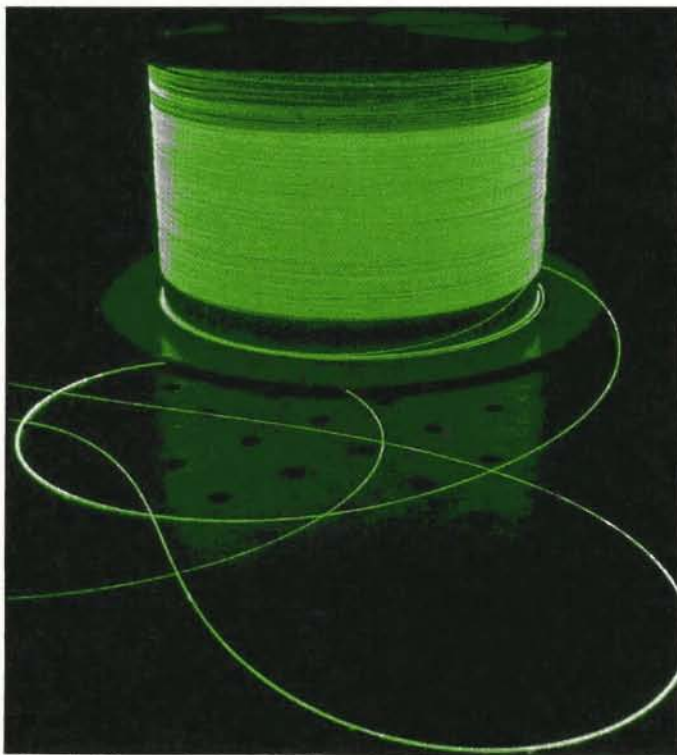


Photo A. Fiber optics is a rapidly evolving communications technology which is of interest to the amateur radio community.

noise in the feedline. Fiber-optic cables are completely immune to electromagnetic noise. You can run a fiber-optic cable right next to the most powerful RF devices without any RF getting into the signal propagating through the cable.

Mobile Radios

Manufacturers of mobile radios have started to embrace fiber optics. Some mobile radios now come with a small but advanced control head which communicates with the transceiver in the trunk through a fiber-optic cable. This technology has also

Optic Fiber Types

There are three main types of optic fibers. Plastic fibers have high attenuation ratings which limit this fiber type to cables that cover up to a few hundred feet. But plastic fibers are cheap and easy to install, and are therefore an attractive material for short cable runs.

Regular glass fibers have some spreading of the signal, since internal reflections from the edges of the fiber ensure that a signal which is sent from one end is received somewhat smeared out in the other end. This smearing limits the amount of infor-

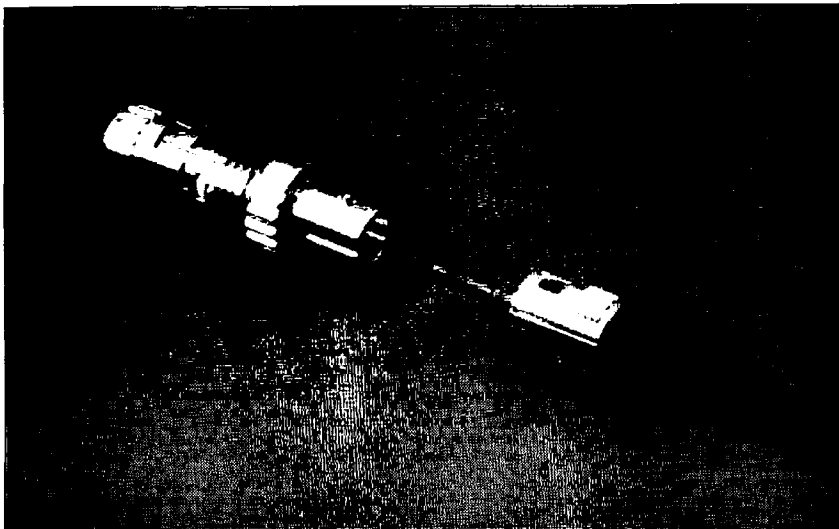


Photo B. A fiber-optic connector. New and easy-to-use fiber-optic connectors with low attenuation are on the market.

mation which can be transmitted. The problem of smearing is especially significant for long cable runs and for circuits that communicate very large amounts of information. This type of fiber, which is the simplest type of glass fiber, is called multi-mode fiber.

A single-mode fiber is an advanced optic fiber. This type of fiber is used in most long-distance fiber circuits. A single-mode fiber has a construction which keeps the light centered in the middle of the fiber throughout the trip, thereby eliminating the problem of smearing.

Connectors have been one of the challenges of the fiber-optics industry. Early fiber-optic connectors were difficult to install and introduced a considerable amount of attenuation in the circuit. However, many large corporations are now competing in the fiber-optic connector market. Connectors have been developed (partly due to the intense competition) that are easy to install and have very little attenuation compared with early fiber-optic connectors.

Modern high speed computing, called supercomputing, would not have reached its present capabilities without fiber-optic communications between computers, control devices and memory devices.

A fiber-optic cable can carry many more television channels than a coaxial cable. Therefore, more and more cable television systems are adopting the use of fiber-optic cables. In cable television systems the optic fibers are used mostly to connect the studio with distribution amplifiers and similar devices. Relatively few homes have been connected directly to optic fibers for cable television.

But it is likely that more and more homes will be connected directly to optic fibers. Not only may the optic fiber bring television into the home, but also telephone service. The technology exists to allow the same fiber-optic cable to be used for both

telephone and for cable television service.

A drawback to telephone service through optic fibers is that the optic fiber cannot bring power to the telephone, unlike a copper telephone wire which serves both as a communications cable and as a power cable for the telephone. The optic fiber must therefore be complemented by copper wires in order to supply the telephone with power. Already, most cables that are laid between telephone switching offices are made with optic fibers instead of copper.

Fiber optics has almost completely taken over for copper in new undersea cables. Currently, there are three transatlantic fiber-optic cables in operation, with a total capacity equivalent to about 200,000 telephone circuits.

A new undersea fiber-optic cable which will connect Europe with the Far East is in the planning stage. This cable will go from Europe through the Mediterranean, the Red Sea, the Indian Ocean and into the Far East. The capacity of this cable could reach the equivalent of more than half a million telephone calls.

The need for repeaters has been a challenge for the manufacturers of trans-oceanic fiber cables. These repeaters need electric power from copper wires, which must be run in addition to the optic fibers in a trans-oceanic fiber-optic cable. The distance that can be covered without repeaters has been increasing due to new fibers, transmitters and receivers. Also, new optic amplifiers may reduce the complexity of new trans-Atlantic cables. Optic amplifiers amplify the optic signal without first converting it into an electric signal. The optic amplifiers also require an electric current supply.

The rapidly evolving fiber-optic technology may offer many interesting capabilities to ham radio. It is therefore well worth the effort to pay attention to this interesting technology and its growing capabilities.

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To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 29 cents!

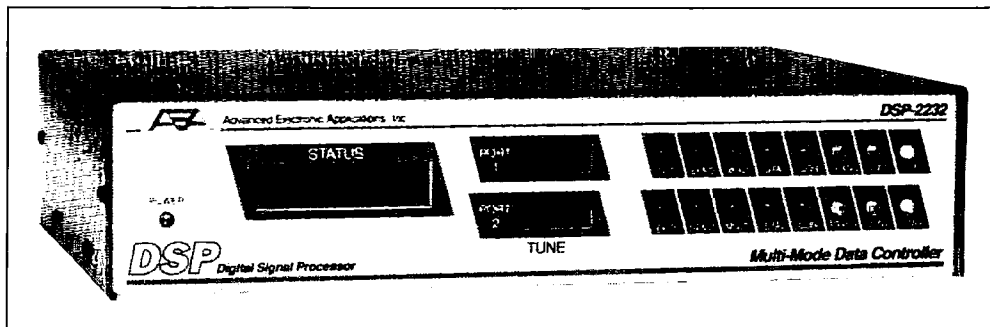
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by Jeffrey Sloman N1EWO

The AEA DSP-2232

Advanced Electronic Applications, Inc.
P. O. Box C2160
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(800) 432-8873
Suggested List Price: \$999

DSP—it seems that you just can't avoid hearing these three letters today anywhere analog signals are in use. Amateur radio gear is no exception. Manufacturers of just about anything that uses filters have jumped on the DSP bandwagon—taking advantage of this up-and-coming technology. The subject of this review—AEA's DSP-2232—is a great example of how DSP can bring intelligence and flexibility to a product traditionally hardwired for a job.



The AEA DSP-2232.

What is DSP?

DSP stands for Digital Signal Processing. DSP uses microprocessor technology to simulate analog filter circuits (in the case of the DSP-2232, the filters used in the modems). DSP has two principle advantages over traditional analog filter design. First is performance: A DSP filter can have very good skirt characteristics. The "skirt" of a filter is the slanted line you see on either side of the filter's frequency response when you plot it on paper. DSP filters are exceptionally sharp, much sharper than even very expensive and sophisticated analog designs.

The second attraction of DSP filters is the fact that they are "virtual." That is, they really only exist in the "mind" of the computer as software. This makes impossible things possible. There are things that a DSP-based filter can do that no amount of time, energy, and money could do to an analog filter. For example, DSP can be used to create "adaptive" filters that actually change their characteristics on-the-fly to adapt to changing conditions. The soft nature of DSP filters also means that new filters—hence new modems, for example—are only a download away. A controller like the DSP-2232 need never become obsolete, thanks to DSP. New mode? Download the firmware and you are on the air. (Note: As of this writing, AEA has not yet set up their BBS to allow downloads, but it is their intention.)

Inside the Unit

The heart of the DSP-2232 is a 24 MHz Motorola 560001 DSP chip. This specialized IC provides the modems for all operating modes. The list of supplied modems is

impressive:

- 300 bauds HF packet (FSK)
- 1200 bauds VHF packet (FSK)
- 2400 bps packet (DPSK)
- 1200 bps packet (BPSK—satellite)
- HF RTTY (FSK)
- Morse
- Facsimile
- SSTV (256 levels)
- 9600 bps (FSK—KK9G)
- 1200/4800 bps ASCII (satellite)
- Dual-port 300/1200 or 1200/1200 packet
- Dual-port RTTY or AMTOR/1200 baud packet

The DSP-2232 uses a Zilog Z-180 embedded microprocessor to handle protocol conversion—that is, to deal with the logic of maintaining an intelligent connection like packet or AMTOR. On the back of the unit are two radio interface ports which operate simultaneously, allowing true dual-port operations in some modes. The DSP-1232 is a single-port version of the controller, though it too provides radio interface connections which may be used one at a time. These radio connections are traditional 5-pin DIN connectors and the manual provides diagrams for connecting the unit to most popular radios using the supplied cables. The five lines available at the interface are: receive audio, transmit audio, PTT capable of +25 to -40 VDC, squelch input, and ground.

Each radio is also supplied with a direct FSK (Frequency Shift Keying) output—available from a single 5-pin DIN—for high speed operation, and a CW keying output (RCA jack)—positive or negative—for Morse code operation. Next to the CW outputs is a satellite up/down frequency control output for Doppler compensation. The current firmware does not use this jack, though some frequen-

cy compensation scheme is in the works.

The computer or terminal device is connected to an AT standard 9-pin D connector which provides RS-232 I/O. The unit is also capable of driving a Centronics parallel printer directly through a 25-pin D connector. Power for the DSP-2232 is a nominal +13 VDC (12-16) @ 1.1 A through a coaxial power connection on the rear panel. No power supply is provided, though a terminated pigtail is included for connection to your shack's supply.

The DSP-2232 is housed in a sturdy aluminum cabinet with an attractively silk-screened front panel. In addition to a full set of standard LED status indicators, the unit sports an easy-to-read backlit LCD display which provides plain text status messages—a very hale feature. Between the LCD and LEDs are two LED bar graph tuning indicators—one for each port.

The Manual

I have mixed feelings about AEA's manuals. As is typical for AEA controllers, the DSP-2232's is quite complete as far as technical information goes. In addition to the extensive radio wiring information, AEA has provided full schematics for the unit. The manual provides step-by-step installation and check-out instructions and extensive tutorials on the various operating modes. Also included is a complete and well-written reference to the commands understood by the controller—though it is not broken down by mode. So, what's the problem?

Most of the beginning users that I spoke to had a hard time getting started using the AEA manual, even with the extensive information provided. It seems that there is no middle ground in reading it. A novice must go through the (potentially) tedious installa-

tion process outlined in the manual step-by-step to use it. Though the described procedure is an excellent one, there is much that could be left out unless a problem arises. Many of the users I spoke with found this process daunting—taking nearly a day to complete in some cases. To be honest, though, I'd much rather use an AEA manual with whatever its flaws than most others I have seen. The AEA manual has the information you need, if you can find it.

Compatibility

The DSP-2232 control firmware is essentially the same as the venerable PK-232. This is good news for those of you who wish to upgrade your PK to a DSP—your current terminal software will work. Those using the PC-Pakratt II (or MacRatt) terminal software will find operation the same. One thing that will need to be improved, though, is the 1-bit (black and white) facsimile display. The DSP-2232 can produce gray scale fax images, but PC-Pakratt II cannot use them. Those of you just starting with AEA products will be able to use any terminal program you wish. If it works with a telephone modem, it will work with the DSP-2232—except for fax.

Performance

If performance is the bottom line, then I

recommend the DSP-2232 without hesitation. On VHF packet, the unit performs like a champ. This isn't too hard, and most TNCs/controllers do. On HF, though, the DSP-2232 shows what it can really do to pull packet, RTTY, and AMTOR signals out of the mud, which other units will not. AEA has lived up to their own tradition of top-

"If performance is the bottom line, then I recommend the DSP-2232 without hesitation."

notch HF performance. Though I was not able to test it myself, those I have spoken to who use the DSP-2232 for satellite operations are very pleased with its performance there—the only disappointment being the lack of Doppler shift compensation at this time.

Some Flaws

The DSP-2232 is not perfect; what is? The good news is that what is lacking is software. All of the complaints are not-yet-implemented features. The frequency

up/down control, for example. There is also currently a lack of software to take advantage of the SSTV and gray scale facsimile, but these are on the way. The DP-2232 is a relatively new product using a relatively new technology. AEA has been very responsive in correcting problems as they are brought to light, and adding features as the production schedule allows. For example, a FACTOR upgrade for the unit is due out soon. This will be a software upgrade—proving the value of DSP.

The other area that some might consider a problem is cost. The DSP-2232 is not cheap. On the other hand, "you get what you pay for" applies to this product as much as any. The box is protected against obsolescence by its DSP technology until our digital modes exceed its computer power. This will certainly happen someday, but it isn't an imminent concern.

Conclusion

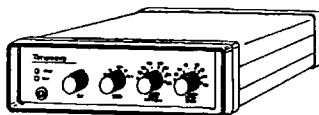
If the price isn't a problem, I can recommend the DSP-2232 without hesitation. It is truly state of the art. Those of you involved in high speed packet, satellite, or HF operations will have a hard time doing better at any price. The DSP-2232 has a safe future. As the VHF packet and HF digital networks mature, the DSP-2232 will follow with just a change of firmware.

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Digital Satellite Gateway Nodes

How to get on OSCAR 22 with an HT.

by John A. Hansen WAØPTV

Ken KE2SR, who lives near Buffalo, New York, is a fairly new Technician class ham who uses his Commodore 64, a Digicom modem, and an HT to communicate on packet radio with hams in Australia, New Zealand and elsewhere around the world via the orbiting satellite OSCAR 22. Impossible, you say? Not at all—he simply uses his local packet satellite gateway node.

The satellite gateway node system is a fairly new development in packet radio satellites. It permits region-wide access by hams with anything from very modest equipment to the latest in digital satellite technology. You don't need a satellite transceiver, you don't need satellite antennas, and you don't need any specialized modems. All you need is a standard bare-bones packet station that is capable of connecting with your local BBS. The "catch" is that there must be a BBS in your area equipped as a satellite gateway node.

The satellite gateway node software automates the interface between a standard packet radio bulletin board system and a high speed (9600 baud) satellite ground station. All users of the BBS (and all other BBSs in the region) can have access to directories of the files available on OSCAR 22, can mark files to be downloaded the next time the satellite is overhead and have those files imported directly into the BBS, and can upload files to the satellite. In short, they can do virtually everything with the OSCAR 22 satellite that they would be able to do if they spent several kilobucks setting up their own satellite ground stations.

About OSCAR 22

UoSat-OSCAR 22 has been in orbit more than a year now. It was built by the University of Surrey in England and represents the current state of the art in digital satellites. It is essentially an orbiting bulletin board with 8 megabytes of on-board storage. The uplink is on 2 meters and the downlink is on 70 cm. Both the uplink and the downlink are FM and run at 9600 baud. Files can be uploaded and received at a very fast rate.

It is possible, for example, to upload a 100K file in about three minutes. Depending on the level of congestion on the satellite, it is possible to receive files from the satellite at about the same rate. On a typical satellite pass of 13 minutes duration, over half a megabyte of data can be obtained. For the most part this data is compressed, so the amount of actual uncompressed data received is quite a bit greater.

Typically, OSCAR 22 passes over any point in the United States six times per day, with three passes in the morning and three passes in the evening. The passes are about 10 to 15 minutes in duration and are spaced about an hour and a half apart. Because of the high data rates used on OSCAR 22, the variety of material available on this satellite is much greater than on a standard terrestrial BBS. In addition to messages between individual hams, there are photographic images taken by the on-board camera; public domain software packages; schematic diagrams; digitized images of hams, their stations and the areas where they live; and digitized voice files. There has been something of an explosion of dig-

ital experimentation on this bird as people have begun to appreciate the implications of being able to easily transfer files that are measured in hundreds of kilobytes rather than in bytes or kilobytes.

Ground Station Requirements

Ground station requirements are fairly modest, requiring FM radios on 2 meters and 70 cm and vertical antennas with a preamp on the 70 cm side. As a practical matter, however, most ground stations access this satellite with OSCAR-13-class stations (high gain, directional antennas) so that in heavily populated parts of the earth, such as the United States, access with vertical antennas is difficult. There are a few other difficulties as well. The radios used must be capable of 9600 baud transmission/reception and the TNC used must have a 9600 baud modem. Because the satellite moves across the sky, there is a problem tuning the radio during the pass to correct for the Doppler shift. The technology is available for automatically tuning the radio and pointing the antennas, but it is difficult to accomplish this cheaply.



Satellite tracking software will let you know when the satellite is within range.

UoSat 22 Directory

Msg#	Size	To	From	T Date	Filename	Subject
a6ff	1544	N4OUL	KG4TM	A 11/10	n4oul.zip	More user info 4U
a712	2746	G3CDK	WAØPTV	A 11/10	GW2656.ZIP	Gateway Nodes
a713	978	VK4BRG	WB2WPM	A 11/10	GW8745.ZIP	THANKS QSL
a708	1373	wb0scd	kd8si	A 11/10	jim1.txt	CTS thoughts
a70a	1878	kd8si	wb0scd	A 11/10	leo.txt	Greetings Leo
a70f	762	ZL2ATI	KB2OUT	A 11/10	GW1913.ZIP	HELLO !!
a71c	1869	WB6LLO	K6OYY	A 11/10	wb6llo.zip	CFG FILES & COMMENT
a725	937	KB7CNN	N7RYW	A 11/10	kb7cnn1.txt	Thanks
a731	1876	G3cdk	oh1kh	A 11/10	roddy	In some ways.....
a732	944	oh7by	oh1kh	A 11/10	pali0911	Onnea vaan
a736	1049	JA6FTL	ZS6AQC	A 11/10	JA6FTL02.ZIP	JA6FTL02
a778	1978	wb6llo	KB2MVN	A 11/10	wb6llo	DL THIS FIRST
a779	1646	WB4FIN	KG4TM	A 11/10	WB4FIN.ZIP	SAS_100 on 2 PC's?
a75f	21759	OH1KH	VK3AHJ	B 11/10	Cats..	
a772	816	wb6llo	jh1aoy	A 11/10	WB6LLO11.10	Thanks reply
a74c	404	dl1cr	hb9aqz	A 11/10	101192.aqz	T_B Kaeschtele?
a74d	865	N4OUL	IT9DLN	A 11/10	N4OUL.TXT	USERS INFO DSP-12
a759	12540	Satgat	VK4TTY	A 11/10	rtty	RTTY NEWS
a768	794	SMØTER	VK4KAA	A 11/10	SMØTER02.ZIP	THANKS
a769	800	ZL1ACO	VK4KAA	A 11/10	ZL1ACO03.ZIP	THANKS
a76b	1122	WB8LEM	VK4KAA	A 11/10	WB8LEM03.ZIP	THANKS
a76c	1988	n4oul	tf3ij	A 11/10	n4oul.001	DSP-12 Users List
a76d	751	on6ug	DJ1KM	A 11/10	on6ug.lzh	FT-736R CAT-Ctrl
a786	747	N4OUL	WB4FIN	A 11/10	n4oul01.zip	User Info
a777	864	W6SHP@WD6	N3CXP	A 11/10	myfile	A QUESTION ABT THE 232
a776	60398	vk3ahj	kb2mvn	B 11/10	family.zip	family.pic
a788	327	IØQGR	N4OUL	A 11/10@IØQGR	REPLY	
a787	698	EA4RJ	N4OUL	A 11/10	EA4RJ2	DSP-12
a71d	612	KA7CMF	K6OYY	A 11/10	jack.txt	THANKS
a71f	1006	wb0scd	kd8si	A 11/10	jim3.txt	Doppler feedback
a720	1172	WH6I	N4OUL	A 11/10	WH6I	DSP-12 REPLY
a774	19195	vk3ahj	oh1kh	B 11/10	ron1011.lzh	Small is beautiful..
a775	774	oh7by	oh1kh	A 11/10	pali0at.tzh	Bat.it
a78e	794	oh1kh	OH7BY	A 11/10	oh1kh.lzh	Kitos ja onnea !!
a711	1951	WD4ASW	WAØPTV	A 11/10	GW1695.ZIP	Re: Progress with DOF
a70b	323	WBØSCD	WD8NNG	A 11/10	lloyd.jim	Lindenblad
a726	2040	N4OUL	N7RYW	A 11/10	n4oul1.txt	DSP-12 User

Notes: Neither ZL2ATI nor KB2OUT own satellite stations, yet they appear on this directory as if they did because they are using gateway nodes.
File a776 is a digitized picture.

Figure 1. Typical Uo22 directory file as it appears on the BBS.

A typical Uo22 ground station consists of a modified Yaesu FT-736R (or ICOM 275/475 or 970 or Kenwood TS-711/811 or 790), a 9600 baud modem, a pair of satellite antennas (such as the KLM 40CX and 22C) and a computer-driven rotator (such as the Yaesu 5400). Many other combinations are possible and it certainly is possible to operate Uo22 with less expensive equipment, but this is a typical station configuration.

Enter the Gateway Node

Many people would like to have the benefits of operating Uo22 but are unable to make the investment required. The Satellite Gateway Node software was designed to meet this need. It integrates a fully-automated satellite ground station with a standard terrestrial BBS. It runs entirely unattended and requires little more sysoping than does a stand-alone BBS. Here is how it works.

Twice a day (after each set of satellite

passes) a directory of the most recent files available on Uo22 is placed on the terrestrial BBS. BBS users can then read that directory (by simply reading the message containing it) to find out what is available. (A typical directory file is displayed in Figure 1.) The directory shows the file number, the file size, who the file is to and from, the date the file was uploaded, the filename, and a subject for the file. In addition, in the "T" column, it shows whether each file is an ASCII type or binary type file. When BBS users request ASCII files, the files are imported into the BBS as standard messages directed to the individuals who requested them. When BBS users request binary files they are moved to a specified subdirectory on the BBS where they can be downloaded by the users who requested them. In the latter case the user is sent a message telling him that his binary file has arrived.

If a BBS user wishes to obtain any of the files in the Uo22 directory, he merely sends

a message to UO22MK @ UO22MK that contains a list of the file numbers he wants. Each time a file is received from the satellite it is placed in a special subdirectory. When someone requests a file from the satellite using the UO22MK procedure, the gateway node first checks this subdirectory to see if the message already exists. If the message exists, it is immediately uploaded to the BBS. If not, it is marked for automatic downloading from Uo22 on the next pass. This is why the system is called a NODE. Files are stored on the gateway node so that a file is never requested from the satellite more than once.

It takes awhile to get used to having to enter a request for a file and then wait until later to actually receive the file. As a practical matter, however, this is what satellite ground station owners have to do as well. Files obviously can only be obtained when the satellite is actually overhead, so users must wait until the satellite comes up, re-

Continued on page 24

Clock It Quick

Tame ripple counter chips.

by Eddie J. Arnold

This article will teach you how to tame ripple counter chips, such as the CD4020, CD4040, and CD4060.

Back in 1988 a guy asked me to build him a timer circuit that would require his kids to put a certain amount of money into a coin slot, thereby allowing them an allotted period of time to watch television. The idea was novel, I thought.

I got the bulk of the circuit working, but not the timing portion. I was using the CD4060 chip in this particular application. I started playing around with certain guessed values to get a "feel" for what kind of time I could expect to receive at respective pinout locations. I was looking for 60 minutes on one pin and 30 minutes on the other, and I also needed 15 minutes on a pin. I can't tell you how many hours I played with that circuit.

The obvious question came to mind: How could I quickly and consistently use the clock portion of the timing chips? This article will provide you with formulas, an example, and even a program written in GW-BASIC. The information presented is straightforward and simple to implement.

Formulas

The following conventions will be used in this discussion:

F = frequency (hertz)

T = time (sec)

2^n = relates to positional value of a positive pin location.

EXAMPLE:

Chip: CD4060

Time: 60,30,15 minutes

Outputs: Three needed for the above times.

Hint: The highest output available is 2^{14} , and remember that there are no outputs for divisions of 2, 4, 8, and 2048. Design for longest period of time, allowing for pin locations for shorter periods to be detected.

See Figure 1:

Oscillator frequency = $2^N/\text{time(sec)}$

Select pin #3 (2^{14}) = dec (16384)

= 2^N . Use for 60 minute outputs.

Results: $16384/(t \times 60\text{sec}) = 4.66 \text{ Hz}$

= (F) frequency

Pin #3 = 60 min.

Pin #2 = 30 min.

Pin #1 = 15 min.

Remember that for the internal oscillator of the CD4060 the following is true:

$F = 1/(2.2 \times R1 \times C1)$. Note: 2.2 in the formulas is the time constant for the circuits.

$C1 = 1/(2.2 \times R1 \times F)$

$R1 = 1/(2.2 \times C1 \times F)$

To use the CD4020 and CD4040 you must use an external oscillator circuit, such as the 555 timer. Simply build this circuit so that its frequency output matches that of the one shown on the GW-BASIC program.

Using the Program

The program is based on the assumption that you want to produce a certain time output at a particular pin number of CD4060 and some similar chip.

To use chips other than the CD4060 you must list line #1100 and insert appropriate decimal weights for the pinouts of the chip you intend to use. The commas in line 1100 are to prevent pins that are not outputs from getting mixed with the pins that your chip is using. So, if you modify the program you must align this location properly or else your data will be faulty. (See the program listing.)

There are several possible applications for this program:

1. Trigger tone circuits (ham radio).
2. Base of an extended timer circuit.
3. Time-to-binary-weight converter. (Is this a new thought?)
4. Morse code test timer (words per minute).

Conclusion

TYPE load "time" to load the program. Modify the program to your delight. There is ample room for many enhancements. Save time and prevent brain damage using this helpful program. Have fun!

See the program listing on the bottom of page 24.

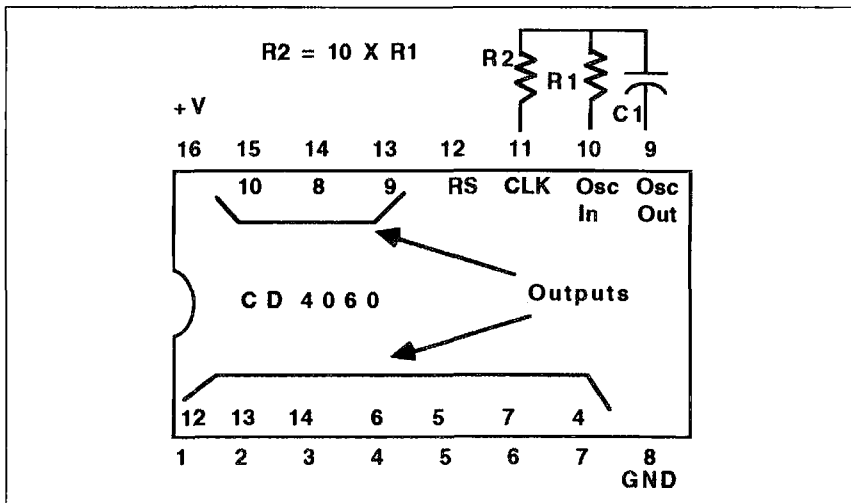


Figure 1. Pinouts.

Digital Satellite Gateway Nodes

Continued from page 20

ardless of whether they are requesting a file from their own ground station or from a gateway node.

To respond to a message that a BBS user has obtained from the satellite the user can use the SR (send reply) command, just as he would to respond to a message that came from any other source. The response will automatically be routed to the satellite. Furthermore, users may initiate satellite contacts by uploading messages either to other satellite users or to ALL, just as they could on a terrestrial BBS. They do this by using the SB (or SP) command: SB ALL @ UO22UP. The destination UO22UP tells the BBS to route the message to the satellite. Messages that come from satellite gateway node users appear on the satellite just as they would if the gateway node user owned and operated his own satellite ground station. In Figure 1, for example, message A70F is from KB2OUT to ZL2ATI. Neither of these stations actually owns their own satellite ground station, yet they appear on the satellite directory just as if they did. Thus, when you see messages on the satellite directory it is impossible to determine whether they came from satellite operators who used their own ground stations or from satellite operators who used a gateway node.

Once a BBS user has uploaded any message to the satellite, his call and home BBS are placed in a special file of satellite users. In the future, any files that appear on the

satellite addressed to this station will be automatically received and imported into the BBS without any action being taken by the BBS users. Thus, the interface between the BBS and the satellite ground station is essentially seamless.

The satellite gateway node is available not only to users of the BBS that is at the gateway node site, but to all other BBSs in the region as well. All the additional BBSs need to do is make sure that all messages that are either @ UO22MK or @ UO22UP are forwarded to the BBS that is at the gateway node site. The gateway node keeps track of the home BBS of each node user and automatically routes all of his or her messages to that BBS. Thus, one gateway node can serve an entire region. In fact, there are significant savings that occur as the service region expands. Since each file is only downloaded once, no matter how many stations request it, as more and more stations use any one gateway node the proportion of file requests that actually involve downloading from the satellite will fall.

How to Establish a Gateway Node

A gateway node consists of a fully-automated satellite ground station (including automatic radio tuning and antenna pointing) and a standard terrestrial BBS. These are fairly stiff requirements (generally in the \$3,000 to \$5,000 category for everything if purchased new), yet there are a

great many such stations currently in existence. Furthermore, since this is no more than the cost of many repeaters, it might be an appropriate project for a club to undertake. Generally, the system will involve a multitasking system such as Desqview, with the BBS running in one window and the gateway node software running in another. Aside from the satellite ground station software (which is available from Compuserve and other sources), all of the software that is needed to run the gateway node is available from the author free of charge. The disk contains complete documentation for setting up the system and a discussion of hardware and software choices that are available. Simply send a formatted disk and a return disk mailer.

It is hoped that the satellite gateway node system will bring the latest in digital satellite technology to many people who would otherwise be unable to participate. It is also hoped that by providing an opportunity for hams to participate in satellite operation without purchasing satellite equipment, congestion on the satellite will ultimately be reduced.

Please remember that amateur satellites are not cheap to build or launch. If you find that you are enjoying using these birds either directly with your own equipment or indirectly using the gateway node system, please support the production and launch of additional satellites by becoming a member of AMSAT.

Clock It Quick

Continued from page 22

```

1000 REM PROGRAM NAME= TIME
1010 REM BY EDDIE ARNOLD :SPRINGHILL,TN
1020 DIM A(20)
1030 CLS
1040 LOCATE 1,25
1050 PRINT"TIME MACHINE 4060"
1060 RESTORE
1070 FOR L= 1 TO 14
1080 READ A(L)
1090 NEXT
1100 DATA 4096,8192,16384,64,32,16,,,,,512,256,1024
1110 LOCATE 3,10:CT=0
1120 SS="MINUTES"
1130 PRINT"TIME =:"
1140 LOCATE 8,10
1150 PRINT"SPACE BAR TO INCREMENT"
1160 LOCATE 9,10
1170 PRINT"ENTER TO STORE"
1180 FOR T= 1 TO 120
1190 LOCATE 3,20
1200 PRINT USING " T= ### MINUTES";T
1210 AS=INKEY$:IF AS="" THEN 1210
1220 IF AS=CHR$(32) THEN 1250
1230 IF AS=CHR$(13) THEN 1270
1240 GOTO 1210
1250 NEXT
1260 GOTO 1110
1270 CLS
1280 LOCATE 5,20
1290 PRINT"MENU"
1300 LOCATE 8,15
1310 PRINT"(1) INPUT R ,FIND C"
1320 LOCATE 9,15
1330 PRINT"(2) INPUT C ,FIND R"
1340 LOCATE 10,15
1350 PRINT"(3) END"
1360 BS=INKEY$:IF BS="" THEN 1360
1370 IF BS="1" THEN 1410
1380 IF BS="2" THEN CT=1:GOTO 1410
1390 IF BS="3" THEN END
1400 GOTO 1360
1410 LOCATE 5,20
1420 INPUT"WHAT PIN# DO YOU WISH TO USE";P
1430 IF P=7 OR P=8 OR P=9 OR P=10 OR P=11 THEN 1030
1440 IF CT=1 THEN 1470
1450 CLS:LOCATE 6,20
1460 INPUT"VALUE OF R1 (OHMS)";R1:GOTO 1490
1470 CLS:LOCATE 6,20
1480 INPUT"VALUE OF C1 (UF.)";C1:GOTO 1530
1490 F=A(P)/(T*60)
1500 M=(R1*2.2)*F:C=1/M
1510 W=C*10^6
1520 GOTO 1560
1530 F=A(P)/(T*60)
1540 M=((C1/10^6)*2.2)*F:R1=1/M
1550 W=R1
1560 LOCATE 8,20
1570 IF CT=1 THEN 1590
1580 PRINT USING "_ C = #####.## _ UF ";W :GOTO 1610
1590 LOCATE 8,20
1600 PRINT USING "_ R1 = ##### _ ohm(s) ";W
1610 LOCATE 9,20
1620 PRINT USING "_ TIME = ### MINUTE(S)";T
1630 LOCATE 10,20
1640 PRINT USING "_ PIN_#::";P
1650 LOCATE 11,20
1660 PRINT USING "_ FREQ: #####.## _ HZ.";F
1670 LOCATE 15,20
1680 PRINT"TO CONTINUE PRESS (Y/N)"
1690 CS = INKEY$:IF CS = "" THEN 1690
1700 IF CS = CHR$(121) OR CS=CHR$(89) THEN 1030
1710 IF CS = CHR$(110) OR CS=CHR$(78) THEN END
1720 GOTO 1690

```

GW-BASIC program.

Dual Half-Wave Antenna

A ground independent antenna with gain.

by Jack Kuecken KE2QJ

In the early days of broadcasting, Ballentine¹ showed mathematically that the maximum ground-wave field strength would be produced by a 5/8-wave vertical antenna. The 5/8-wave radiator is theoretically 2.9 dB superior to a quarter-wave and 1.2 dB better than a half-wave. Because of the gain advantage, the 5/8-wave vertical is relatively popular in 2 meter mobile applications, despite a few drawbacks.

By 1934, Friis, Feldman and Sharpless² at Bell Labs had shown that a vertical half-wave antenna consistently showed a superiority of about 4 dB compared to a vertical quarter-wave, despite the fact that the theoretical advantage is only 1.7 dB. They reasoned that the losses in the counterpoise were much greater for the quarter-wave since the maximum current occurred at ground level. By comparison, the current maximum is halfway up the radiator on the half-wave and the minimum is at ground level.

Mobile Antenna Background

At the U.S. Army Signal Corps labs, Brueckman³ showed that for mobile antennas, coupling to the vehicle and dependence upon ground can be minimized by placing a current minimum at the antenna base. This decoupling provided much improved circularity in the radiation patterns and made antenna tuning independent of the vehicle type and size. This work led to a number of developments in military "antennas^{4,5}", including the very widely used AS-1729 autotuned antenna, which covers the military 30 to 76 MHz FM range.

For my own 2 meter mobile setup I developed the antenna illustrated in Figure 1. I drive a convertible, which presents several problems. First, you cannot mount the antenna on the roof; second, the car seems to have more electrical noise than a closed sedan. Since the radiating element is a half wavelength high, the current at the base of the antenna is minimal and the coupling to the car skin is minimized. The noise pickup from this antenna is significantly lower than the noise pickup from a quarter-wave type. I have not actually measured the circularity of the radiation patterns on the car but no noticeable nulls exist. Since the 5/8-wave-length antenna does not have a current minimum at the base it does not enjoy the benefits of ground independence.

The small LC network at the base of the antenna provides an efficient transformation

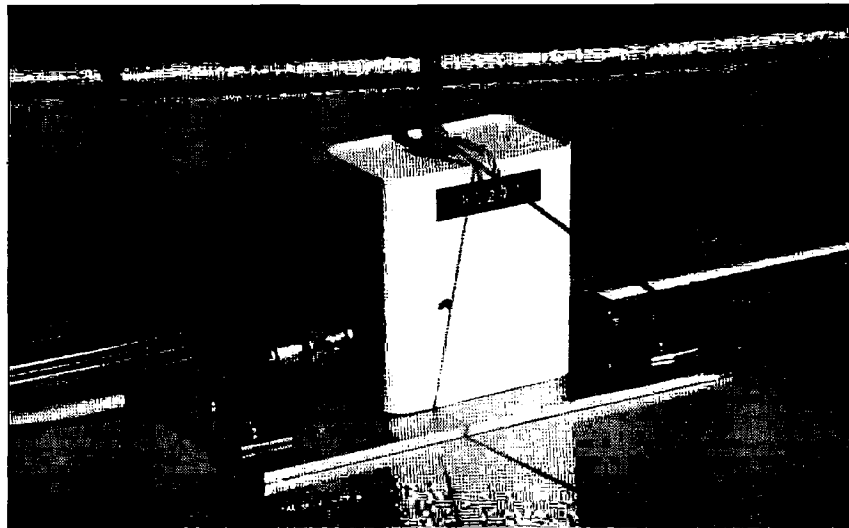


Photo A. The 2 meter mobile antenna mounted on a car. The two hooks catch the edge of the truck lid and the nylon string under tension holds the whole unit on via a hook caught on the lip of the trunk.

from the very high impedance of the radiator (about 2,700 ohms) to the 50-ohm transmission line. The antenna covers the range from 144 to 148 MHz with a maximum VSWR of 1.6 at the band edges and about 1.1 at band center. I found that with a 3" x 5" ground plane the antenna remains matched even sitting on a wooden cabinet! I installed one of these antennas at the peak of my roof for a base station antenna and have been delighted with the results. The lack of a requirement for a counterpoise is a significant advantage.

Two Half Waves in Phase

In the interest of narrowing the elevation pattern and obtaining more gain from the omnidirectional base antenna, I considered using two half-wave vertical antennas, one above the other, phased to add in the far field.

Figure 2 shows that the generator driving

the two from a center gap produces currents which are in phase when viewed from a distance, although they are obviously out-of-phase at the generator terminals. The free-space patterns shown in Figure 3 illustrate the results to be expected. The dual half-wave antenna will provide a pattern which is 52 degrees between elevation half-power

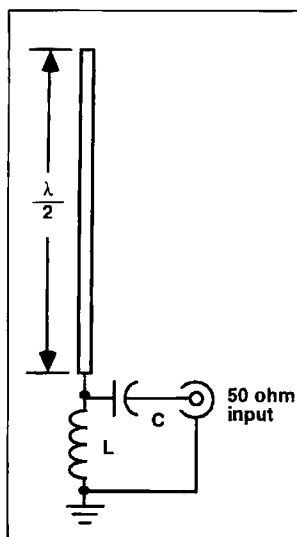


Figure 1. The ground-independent vertical half wave.

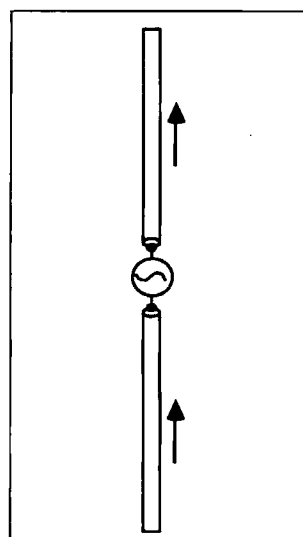


Figure 2. Two half waves in phase.

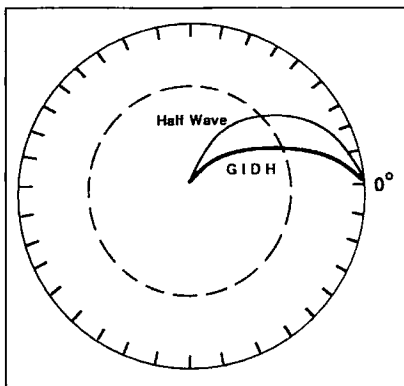


Figure 3. Elevation patterns of half-wave and ground independent dual half-wave.

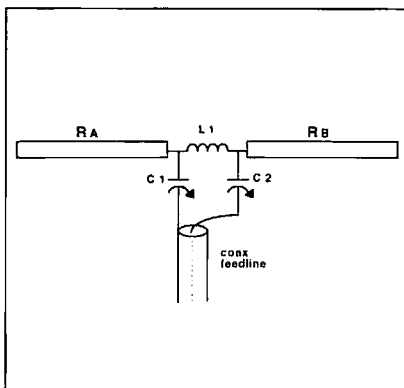


Figure 4. Antenna circuit.

points, compared to 78 degrees for the half-wave. Furthermore, the directivity will be 1.4 dB higher than the half-wave. Note that the elevation pattern has fourfold symmetry and only a quarter of the pattern is plotted.

The narrower elevation pattern is an advantage by itself. For one thing, it reduces the reflections from passing aircraft (which can cause a considerable flutter in the received signal). Secondly, it reduces the reflections from foreground objects, which can distort the pattern.

The Antenna Construction

After several false starts I developed the feed circuit shown in Figure 4. I had some lengths of 7/8" o.d. aluminum tubing from a scrapped array. These were used for the radiators. Experimentally, I found that the highest impedance resonance at 146 MHz, for this tubing diameter, could be obtained with 38" radiators. By jiggering the values of C1, C2 and L1 it was possible to obtain a very good match to 50 ohms. A measurement of current magnitude and phase showed that the radiator currents were equal and in phase as seen in the far field.

Figure 4 is intended mainly to clarify the matching scheme. The construction is shown more clearly in Figure 5. The coax feed cable was actually run up the center of the lower radiator. The dielectric beads at the upper and lower radiator ends are used to center the coax and to provide a measure of tuning. At the center of the lower radiator a shorting

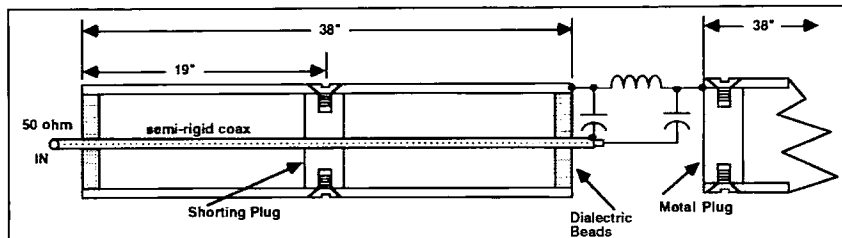


Figure 5. Basic construction.

plug is inserted which shorts the outer conductor of the coax to the inside of the lower radiator, thereby making AB and DC a pair of quarter-wave (not quite) coaxial chokes. The coax used is 0.140" o.d. semirigid 50-ohm cable. If the shorting plug is made of brass it may be soldered directly to the copper tubing outer jacket of the coax. If the plug is made of aluminum, fashion a brass or copper sleeve which can be soldered to the coax and connected to the aluminum with screw pressure. One source for the miniature semirigid coax is Precision Tube Co. Inc., Microwave Division, Church Road and Wisnicksen Ave., North Wales PA 19454.

The two little capacitors used are Johanson air variable 0.7-to-10.5 pF units. I picked these up at a hamfest for a few cents. A pair of piston caps might be better since they can handle more power and are easier to tune. The inductor consists of three turns of #16 tinned wire wound on a 3/4" form. We will discuss tune-up later.

The insulators for this unit were made from white PVC water pipe. The construction is shown in Figure 6. The construction technique used on this model is best suited to those who have a lathe available, but other constructions not requiring a lathe are also feasible.

The radiators are, as noted earlier, 7/8" o.d. aluminum tubing. In order to get a good fit, the nominal 1" pipe, which is actually 1.063" i.d., must be shimmed. To do this I cut two 1.25" lengths of the pipe. I then cut out a portion of the circumference so that I could compress the remaining segment into a 1" diameter cylinder. I then slathered some PVC pipe glue on the center piece and the insert and drove the insert in with a soft mallet. Immediately upon insertion, clamp the insulator in a vise to round up the egg shape that develops because of the uneven push of the insert.

The PVC glue dries very fast. When the first end of the center insulator is done, do the other end. After the glue has dried for about a half hour the insulators may be bored out in a lathe to give a good fit for the upper and lower radiators. After the boring operation, the center insulator should have a center window about 1/2" x 1" opened to permit connection to the coax.

The base insulator is made similar to the center insulator except that only one end is equipped with an insert. The base flange is made of any convenient material. It may be either metal or plastic. It must, of course, be strong enough to hold the overturning mo-

ment due to wind loads on the radiators. In my case, I made it by laminating two pieces of 3/8" XXXP plastic (a paper-base melamine) and boring the assembly to accept the base insulator outside diameter.

Assembly

To begin with, prepare the ends of the miniature semirigid coax. At each end mark

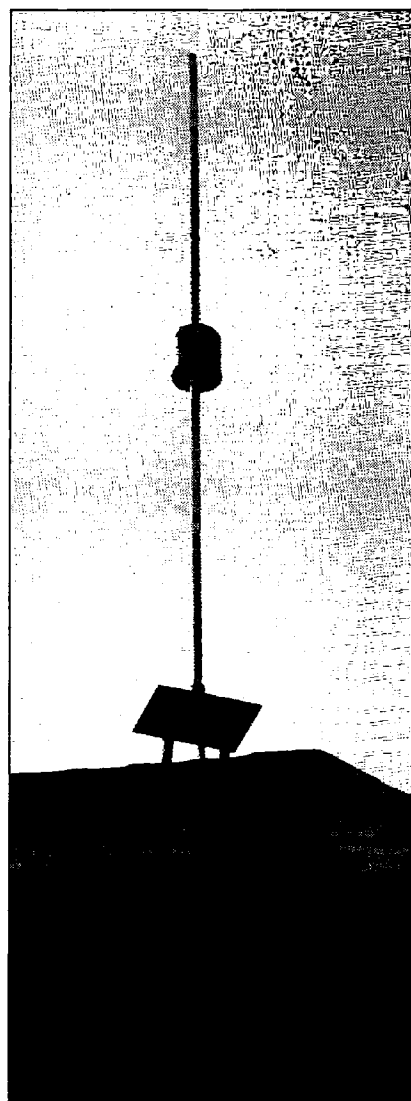


Photo B. Dual antenna, showing the plastic bottle covering the matching network in the center of the antenna and the miniature ground plane.

RF POWER AMPLIFIERS

NEW!
400 WATTS
AVG.
(144-148 MHz)

Model Pin (W) Pout (W) Ic (A) Gain/NF (dB) (dB) (13.8 V) Type

50 MHz						
0503G	1-5	10-50	6	15/0.6	LPA	
0508G	1	170	28	15/0.6	Standard	
0508R	1	170	28	+	Repeater	
0510G	10	170	25	15/0.6	Standard	
0510R	10	170	25	+	Repeater	
0550G	5-10	375	60	15/0.6	HPA	
0550RH	5-10	375	60	+	Repeater HPA	
0552G	25-40	375	55	15/0.6	HPA	
0552RH	25-40	375	55	+	Repeater HPA	

144 MHz						
1403G	1-5	10-50	6	15/0.6	LPA	
1406G	25	100	12	15/0.6	Standard	
1409G	2	150	25	15/0.6	Standard	
1409R	2	150	24	+	Repeater	
1410G	10	160	25	15/0.6	Standard	
1410R	10	160	24	+	Repeater	
1412G	25-45	160	20	15/0.6	Standard	
1412R	25-45	160	19	+	Repeater	
1450G	5	350	56	15/0.6	HPA	
1450RH	5	350	56	+	Repeater HPA	
1452G	25	350	50	15/0.6	HPA	
1452RH	25	350	50	+	Repeater HPA	
1454G	50-100	350	40	15/0.6	HPA	
1454RH	50-100	350	40	+	Repeater HPA	

220 MHz						
2203G	1-5	10-40	6	14/0.7	LPA	
2210G	10	130	20	14/0.7	Standard	
2210R	10	130	19	+	Repeater	
2212G	30	130	16	14/0.7	Standard	
2212R	30	130	15	+	Repeater	
2250G	5	220	40	14/0.7	HPA	
2250RH	5	250	40	+	Repeater HPA	
2252G	25	220	36	14/0.7	HPA	
2252RH	25	250	36	+	Repeater HPA	
2254G	75	220	32	14/0.7	HPA	
2254RH	75	250	32	+	Repeater HPA	

440 MHz						
4403G	1-5	7-25	4	12/1.1	LPA	
4410G	10	100	19	12/1.1	Standard	
4410R	10	100	18	+	Repeater	
4412G	20-30	100	19	12/1.1	Standard	
4412R	20-30	100	18	+	Repeater	
4448G	5	100	22	12/1.1	HPA	
4448R	5	100	22	+	Repeater HPA	
4450G	5-10	175	34	12/1.1	HPA	
4450RE	5-10	175	34	+	Repeater HPA	
4452G	25	175	29	12/1.1	HPA	
4452RE	25	175	29	+	Repeater HPA	
4454G	75	175	25	12/1.1	HPA	
4454RE	75	175	25	+	Repeater HPA	



MODEL 1410G
STANDARD



MODEL 1450G
HPA

All amplifiers (non-rpt) are linear, all-mode with fully automatic T/R switching and PTT capability. The receive preamps use GaAs FET devices rated at 5 dB NF with +18 dBm 3rd order IP. LPA, Standard and HPA amps are intermittent duty design suitable for base and mobile operation. Repeater amps are continuous duty, class C.

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RX Preamplifiers

Band	Model	NF (dB)	Gain (dB)	Connector
50 MHz	0520B	5	25	BNC
50 MHz	0520N	5	25	N
144 MHz	1420B	5	24	BNC
144 MHz	1420N	5	24	N
220 MHz	2220B	5	22	BNC
220 MHz	2220N	5	22	N
440 MHz	4420B	5	18	GNC
440 MHz	4420N	5	18	N
1.2 GHz	1020B	9	14	BNC
1.2 GHz	1020N	9	14	N



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off 1/4" from the end and carefully score a circumferential ring in the outer conductor tube with a sharp knife. Grasp the piece with a pair of pliers and gently work back and forth. The outer tube will break circumferentially along the scored ring and the piece can be pulled off. Next, cut the Teflon™ insulation at a point 1/8" from the end of the tube, as shown in Figure 8. Take care at this point not to score the center conductor.

If the shorting plug is brass, slide it into position on the coax and solder it into place. If the plug is aluminum, slide the protective brass bushing into place and solder it. The shorting plug should be placed so that the prepared end of the coax projects beyond the end of the lower radiator into the center of the gap between the upper and the lower radiator.

The dielectric beads can be made from polystyrene, G-10 epoxy Fiberglass™, Kel-F, Teflon or other dielectric with a low dissipation factor at 146 MHz. Do not use plexiglass or melamines. These washers are easily turned on a lathe but may be filed out by hand. A perfect fit is not necessary; however, the coax should not rattle too much.

Next, slide the dielectric beads onto the coax. These may be held in place with a drop of epoxy. The beads should be positioned to fall in the open ends of the lower radiator and should hold the coax centered.

The next step is to install the BNC connector. There are cable connectors made to directly accept the semirigid coax but they are not often seen at hamfests. Figure 8 shows how a standard BNC connector can be adapted to this coax. I used a UG-291B/U female so that a normal, male-ended cable can be attached without an adapter. The adapter brushing is used to make the coax fit the connector. First slide the nut, the flat washer and the gasket on the coax. The washer may have to be reamed slightly to fit over the shank of the adapter. The bushing is then slid onto the end of the coax with the flange flush, with the end of the outer conductor and sweat soldered in place. The pin is then soldered to the center conductor and the connector assembled. The piece which normally holds the braid and interfaces to the gasket is not used.

Leads of approximately 1.5" are next soldered to the end of the coax which will go into the insulator. Bend these leads more or less parallel to the axis.

If an aluminum plug is used, drill and tap a radial hole from the periphery of the plug to the hole for the bushing. Insert a 4-40 headless setscrew to lock the bushing in place.

Next, mark and

drill a #39 hole 19" up from the base of the lower radiator. Mark the center of the shorting plug and slide the coax into the lower radiator until the mark shows through the hole. Drill and tap for three 4-40 flathead screws to secure the plug. Flathead screws permit one to slide the lower weather seal up the lower radiator.

Next, fasten the center insulator to the upper radiator. This can be a permanent joint. I use a cement used to mend vinyl and leather, found in shoe and leather stores under the names "Shoe and Leather Patch" or "Shoe Goo." An RTV cement can also be used. Slide the radiator 1.25" into the insulator.

Next, slide the insulator onto the upper end of the lower radiator without glue (you may wish to disassemble this joint later). Now drill and tap through the insulator into the upper radiator and lower radiator to make an electrical connection to each. Sheet metal screws may also be used.

Put a terminal lug on the upper and the lower radiators. Additional screws may be

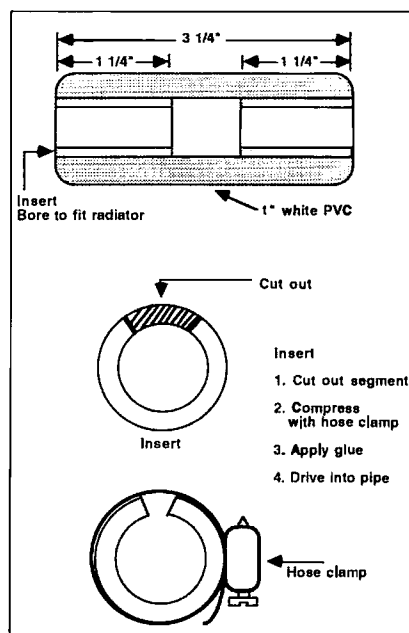


Figure 6. Center insulator.

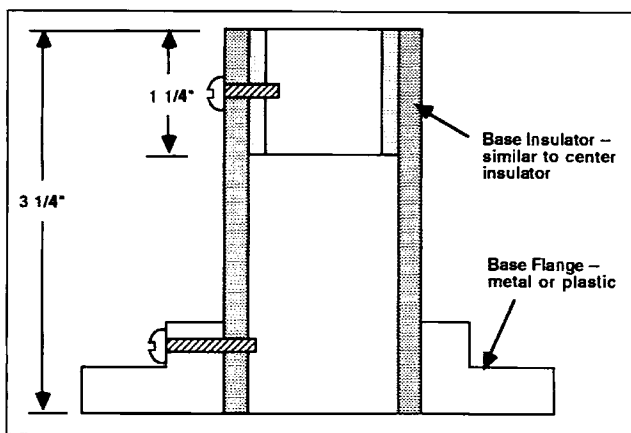


Figure 7. Base assembly.

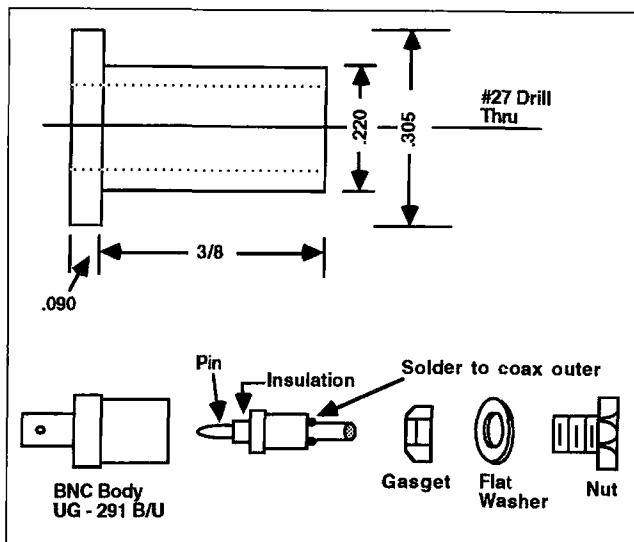


Figure 8. Cable assembly.

added at this point to secure the insulator to the radiators.

Reaching in through the window in the center insulator, pull the leads from the inner and outer conductor out through the window. Solder the coil between the terminal lugs and solder each capacitor between one of the leads from the coax and one of the end terminals on the coil.

Insert the bottom end of the lower radiator into the base insulator and insert the base insulator into the base flange. Mount the antenna somewhere in the open and get ready to tune it.

Tuning Up

For the tune-up procedure you will need a signal source and some form of system to detect the matched condition. A directional coupler or SWR meter can be used; however, I prefer the use of a bridge circuit because it's more accurate. See the *Radio Amateurs Handbook*. In the 1990 edition, Chapter 25, pages 9 and 10 and Figure 21 give suggested circuits.

Set the signal source to 146 MHz. Next, tune the two capacitors for the deepest null available. Try to keep the capacitances equal. The coil was initially close wound; stretch it axially a little bit. This decreases the inductance. Re-null the capacitors, again trying to keep them equal. If the null improves, you went in the right direction. Stretch the coil again and repeat the nulling. Eventually you should reach a point where the inductance is too small and the reflection starts to rise again. Back in to obtain the deepest null possible.

If a reasonably sensitive bridge is used, you will find that as a good null is approached the motion of your body within four or five feet of the antenna will cause the reading to change. It will be necessary for you to de-tune the antenna in such a direction that the match improves as you walk away. Done properly, you should be able to attain a VSWR less than 1.1 : 1 at the center of

the band, running out to less than 1.7 at 144 and 148 MHz. The Smith chart shown in Figure 9 shows the results of a measurement obtained using a General Radio model 1602B UHF admittance meter. The data has been rotated to the center of the antenna at the feed-point. The VSWR's represented range is from 1.63 at 144 MHz to 1.45 at 148 MHz. The tuning can easily be shifted to favor one end of the band or the other.

For weather protection, I cut off a plastic bottle and cut a hole through the bottom of the bottle to closely fit around the upper radiator. This is placed upside down over the coil-capacitor assembly. A bead of RTV or shoe cement is used to seal the upper radiator. On the bottom side, the bottle top was similarly fitted around the lower radiator with the flange down. The lower edge of the upper part hangs below the upper edge of the bottom part. These are not tightly fitted or sealed. Instead, they are designed to be drip-proof and so that some air can circulate. My experience has taught that if you cannot get a true hermetic seal, you are better off to arrange matters so that air can circulate and water and condensation can run out.

The open end of the upper tube can be neatly sealed with a wine bottle cork. The brand is not important. My personal taste runs to dry white wines, however, a cork from a sherry bottle would do as well.

For mounting the antenna, a 3" x 5" or 5" x 7" ground plane is adequate. The BNC fitting should be in the center of the base insulator so that the driving cable is protected from rain, etc. No goopy sealing of the cable should be required. If you wish you can insert a rolled sheet of plastic into the bottom of the base insulator to protect the joint.

References:

1. S. Ballentine, "On the Optimum Transmitting Wavelength for a Vertical Antenna Over Perfect Earth" *Proc. IRE*, Vol 12, Dec. 1924, pp. 833-839.
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4. H. Brueckmann, U.S. Patent 2,913,722 November 1959.
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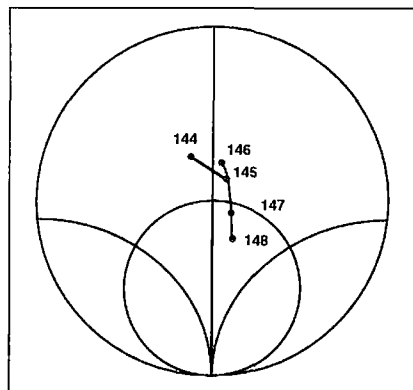
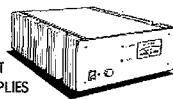


Figure 9. Smith impedance chart of ground independent dual half-wave.

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Active Antenna Using a MOSFET

Build a low noise antenna.

by Ken Cornell W2IMB

I first became involved with active antennas back in the late '70s while experimenting with communications on the 160 to 190 kHz FCC Part 15 band. Due to the high ambient noise level encountered in this frequency range, the search for an efficient and low noise receiving antenna was an interesting experimental endeavor. The longwires and 50-foot vertical used for transmitting were noise collectors in most locations.

Quite a few of us LOWFERS (short for "low frequency experimental radio station") started to use various designs of active antennas that consisted of a short whip vertical some three to six feet long with a preamplifier built into the base. The antenna was connected via a random length of coax to a receiver coupler located at the station's operating position. Since it is relatively small and lightweight, it was easy to move it around the homestead and place it in the position offering the best signal-to-noise ratio.

The use of JFETs, such as the MPF102, was popular, and I have offered several designs in some printed articles and in my *Low & Medium Frequency Radio Scrapbook* series.

Using MOSFETs

While experimenting with transmitters on the 510 to 1705 kHz band (again an FCC Part 15 band; 100 mW to a 3 meter antenna,) I found that the Amperex BS170 and the ZETEX BS170P were excellent final amplifiers. They are MOSFETs.

I decided to try them out as an active antenna preamplifier. After quite a few breadboard layouts, I ended up with the circuits shown in Figures 1 and 2. I was quite pleased with its performance.

Since the active antenna consists of a short vertical with a broadband preamplifier, I decided to put the entire unit within a five-foot length of white PVC pipe. Placing a PVC pipe cap on each end would make the unit weathertight. A coax fitting is placed in the bottom cap.

The circuit for the active antenna is shown in Figure 1. Since the coax cable provides two functions—one to feed the antenna to the receiver and the other to supply power to the MOSFET—we need a receiver

coupler and a power supply isolator. This circuit is shown in Figure 2.

An SPDT switch is added to the receiver coupler circuit to allow selection of either the active antenna or a reference antenna for comparison purposes, or to select the best antenna for signal-to-noise ratio.

The active antenna circuit is wired up on a 1" width of perf board. I used RG-59U coax cable and installed an F-81 coupler (Radio Shack #278-213), with the long-threaded

shank to the inside, in the bottom pipe cap. The antenna assembly is shown in Figure 3.

The actual antenna is a length of 1" aluminum tubing with a hole for a 6-32 machine screw at each end. The top hole is for securing the aluminum antenna tube to the PVC pipe. The bottom hole is for connecting a short length of flexible wire from the tube to the antenna input on the circuit board. A short length of RG-59U coax connected to a CF-59U male "F" connector is used to con-

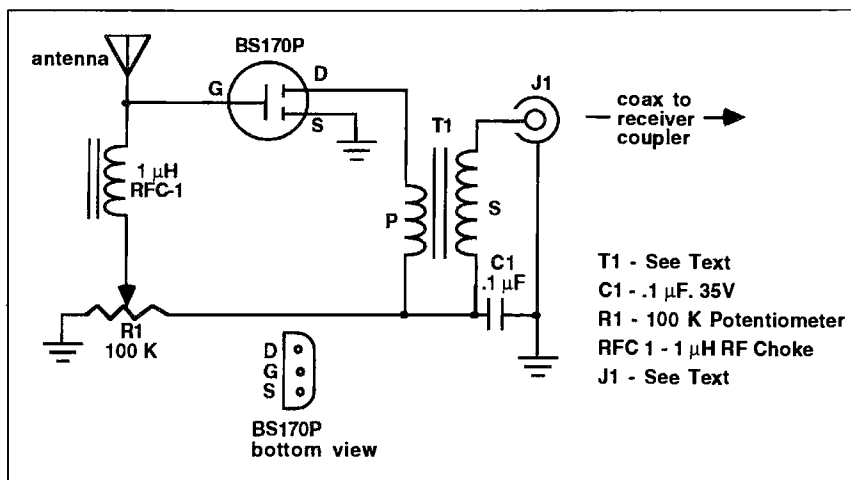


Figure 1. Active antenna.

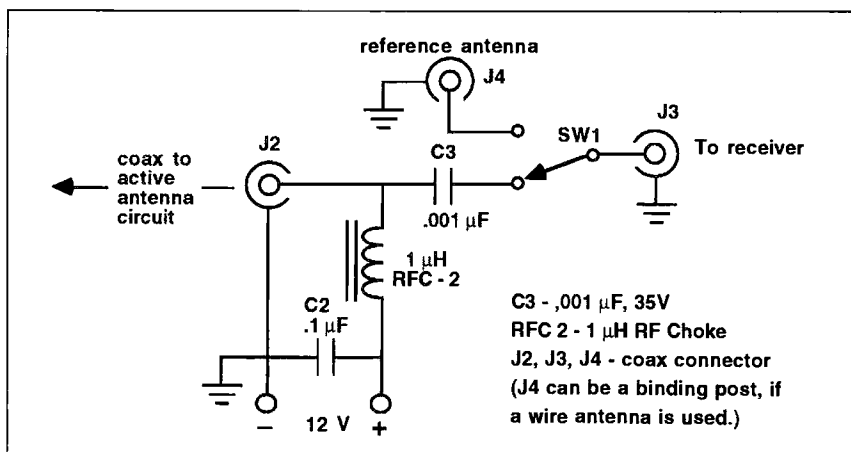


Figure 2. Receiver coupler.

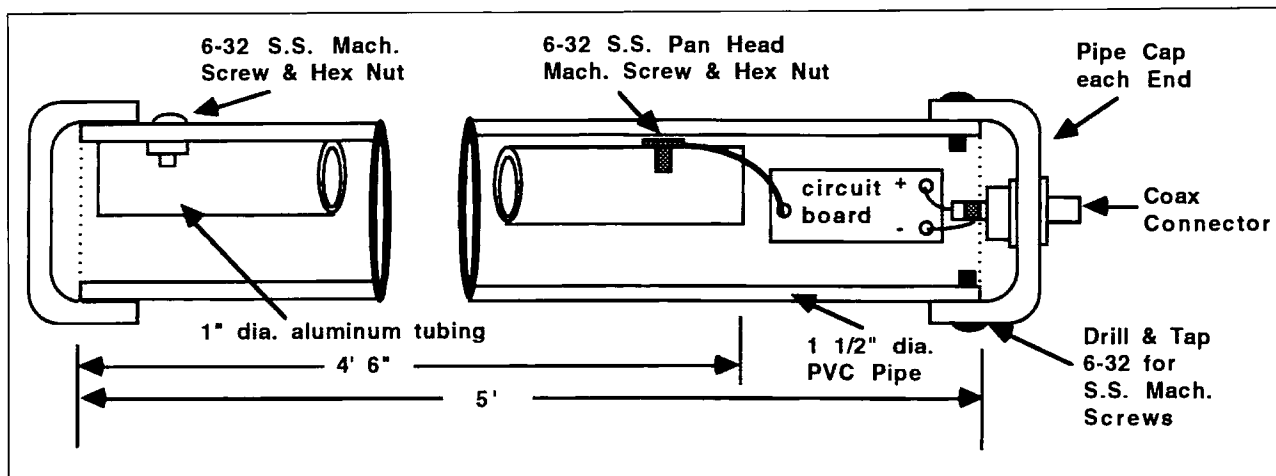


Figure 3. Active antenna assembly.

nect the coax cable feed to the circuit board, as shown in Figure 3.

For testing, connect the coax fitting (secured in the bottom pipe cap) and the antenna to the circuit board, laid out as it would be in the assembly, then connect the active antenna to the receiver coupler and the coupler to the receiver. Apply power. Adjust the 100k potentiometer to provide between 15 and 25 mA to the preamplifier. Then check the antenna for performance. If desired, the potentiometer can be removed and the resistance each side of the arm measured. Fixed resistors could be substituted.

Assembly

The assembly can now be slid into the PVC pipe, starting with the aluminum tube end. The top of the aluminum tube is centered on a predrilled hole in the top of the PVC pipe and the tube is then secured with the machine screw and nut. The bottom pipe cap is firmly pressed on and then drilled and tapped on two sides for 6-32 securing

screws. I suggest using stainless steel fasteners.

The antenna is mounted vertically. I used Radio Shack #15-883 4" wall mounts. The "U" bolts that come with the mounts are not wide enough for the PVC pipe so they are not used. The hole spacing of the outer clamp needs to be made wider. I did this by placing the part on a sturdy support with the "V" shape up, then hitting it with a hammer to spread the holes. I then used 2-1/2"-long bolts to clamp the antenna.

The active antenna output transformer "T1" is wound on an Amidon FT50-43 toroid form. The primary has nine turns and the secondary 18 turns. You can use #26 to #30 enameled wire.

I obtained my MOSFETs from Digi-Key Corp., P.O. Box 677, Thief River Falls MN 56701. I used the ZETEX BS170P. I noted that they also list a Philips BS170PH. ZETEX also offers a VN10LP that experimenters may be interested in.

While the turns and ratio of turns on "T1"

is what I used, some experimenters may try different windings, depending on their favorite range of frequencies. However, it is a

broadband device.

After assembly, caulk the pipe caps and the heads of all screws to insure weather-proofing. I also suggest caulking the coax connector in the bottom pipe cap.

Another scheme for mounting would be to add an eyebolt in the top pipe cap and hang the antenna from a supporting structure. In this case, securing screws should be added to the top pipe cap as in the bottom pipe cap.

Don't just pick a spot to locate the antenna. Use a buddy and move the antenna around to find the quietest location as to the signal-to-noise ratio. Sometimes moving it only a few feet one way or another will make a big difference in the noise level. Also, don't think that adding a long antenna will improve the performance; you will be getting more noise pick-up. The preamplifier will make up for the lack of aperture.

To eliminate the chance of corrosion around the antenna's coax connectors I recommend that, once you have established their location and determined the coax length, you feed the coax directly through the bottom pipe cap and solder it to the circuit board input terminals. Use a cable clamp on the inside and then caulk the cable entry.

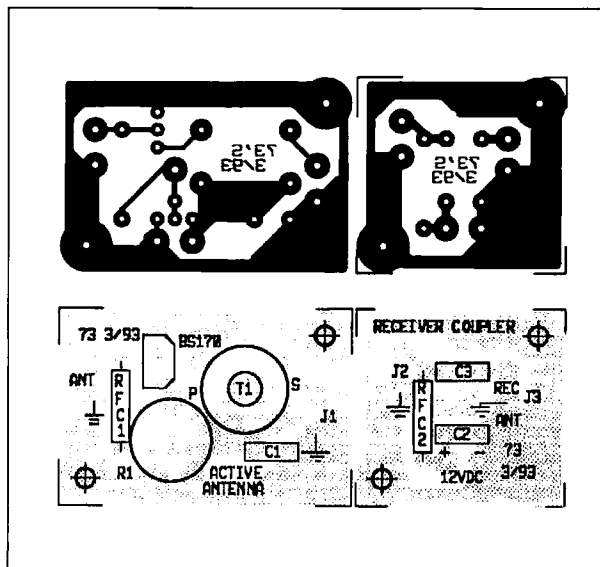


Figure 4. PC board pattern and parts placement for active antenna and receiver coupler.

PARTS LIST

Active Antenna

T1	See text
C1, C2	0.1 μ F 35V disc
C3	0.001 μ F 35V disc
R1	100k potentiometer, Radio Shack #271-284

Receiver Coupler

RFC 1 & 2	1 mH RF choke*
J1	See text
J2 to J4	Your favorite coax connector. J4 can be a binding post if a wire antenna is used for reference.

*1 mH RF choke is for 160 meters and above. For low frequency work (160-190 kHz) try substituting a larger choke, such as 4.7 mH. Circuit boards are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for \$4.50 (set of two boards) plus \$1.50 shipping and handling.

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

A new high-altitude amateur satellite is expected to be launched and commissioned this April. The French ARSENE satellite is a Phase-3 class satellite with a high orbit and a large complex spaceframe.

The French Connection

Over 15 years ago, a group of amateurs in CNES (National Center for the Study of Space—France) proposed that France should support amateur radio space activity with a major satellite construction project. The idea was submitted to directors at CNES in 1978, where it received favorable response. No financial commitment was required, but the CNES promised support in the form of space-ready parts that were not suitable for future commercial or government projects. The CNES also offered to provide space on an Ariane flight where the entire capacity of the booster was not needed by the paying customer.

The ARSENE satellite program was organized with cooperation from three groups and various individuals. Industry was represented by the CNES, the radio amateurs through RACE (Radio Club de l'Espace) and schools through ENSAE (l'Aeronautique et de l'Espace). The French equivalent of the American Radio Relay League, the REF (Reseau des Emetteurs Francais), joined with RACE to support the program.

By 1979, initial contacts had been made between the three groups involved in the program. They considered proposals for various satellite configurations and final orbits. Complete documentation was expected by the end of 1982 or 1983, with an estimated time for satellite construction of two years. They anticipated launching sometime in 1985. These goals were not met, but instead of dying, the program progressed methodically through the 1980s. Today ARSENE is a reality and is waiting for launch on an Ariane type 42L launcher with the geostationary TV satellite ASTRA 1C from French Guiana.

ARSENE Today—The Satellite

At launch, ARSENE weighs 150.6

kg. It has six sides, not including the top and bottom. The main unit's diameter is 785 mm, the height is 618 mm. Encompassing the maximum extension for antennas and other portions of the satellite, the dimensions increase to almost a meter in diameter and over a meter in height. The satellite will be spin-stabilized around the north/south axis, which will be held perpendicular with the equatorial plane of the earth. Attitude control will be handled by nitrogen jets.

Power for the spacecraft comes from GaAs (Gallium Arsenide) solar panels from Italy generating 60 watts. The communications payload supports a digital Mode B (70 cm up and 2 meters down) and an analog Mode S (70 cm up and 13 cm down). Note Table 1 for a list of operating frequencies by mode. The two modes cannot be operated simultaneously, but will be controlled by a schedule to be determined after launch.

The digital Mode B system represents a departure from the current use of PSK or high-speed FSK in use on most current microsats and Uosats. ARSENE employs standard AFSK (Audio-Frequency Shift Keying) AX.25 packet. With three uplink frequencies on 70 cm and a single downlink on 2 meters, the system can be accessed by anyone using a standard TNC (Terminal Node Controller) in conjunction with appropriate VHF and UHF radios and antennas. No special modems or radio modifications are required.

The 2 meter downlink runs 15 watts out in the high-power mode and 2 watts in low-power. Packet operation is specified at 1200 bps with standard 1200/2400 Hz tones. The system works as a digipeater and does not support an on-board mailbox. The possibilities for such a satellite system are endless, but congestion is expected to be a problem.

The Mode S transponder is 16 kHz wide but will support any type of modulation that is sent on the 70 cm uplink and fits the channel. Power output is 800 mW. The downlink frequency is quite distant from that used for AMSAT-OSCAR-13 (over 40 MHz), so modifications to current Mode S receivers will be necessary.

The Orbit

The desired orbit for ARSENE is equatorial with an apogee (high point of the orbit) of 36,000 km and a perigee (low point of the orbit) of 20,000 km. The Ariane rocket will place the satellites in a geostationary transfer orbit. This transfer orbit is highly elliptical and, due to a low perigee, is not suitable for a final orbit. The ASTRA satellite will then be boosted to a geostationary position over the equator. ARSENE has its own solid-rocket motor. At the apogee of the fourth orbit the main ground control station will command the firing of the internal booster. This will give ARSENE its final orbital characteristics with a period of 17.5 hours. The ground track should closely follow the equator. Good access is expected

even for stations above (or below for the Southern Hemisphere) 60 degrees latitude.

Operating with ARSENE

Activity via the Mode S analog transponder will at first be quite light due to the downlink frequency in use. The satellite's operating schedule will likely allocate only a small portion of each day to Mode S. Terrestrial 13 cm systems use 2304 MHz and A-O-13 operates near 2400 MHz. ARSENE's use of 2446 MHz will likely be responsible for conversion and new construction articles. Link margins show that uplink requirements will be similar to A-O-13, i.e. about 300 watts ERP (Effective Radiated Power). This can be accomplished

Continued on page 40

ARSENE Analog Telemetry Equations

Channel	Units	Parameter	Equation
A3	I	Battery unload current	$y=1.664v+0.198$
A4	V	Battery end chg. thresh.	$y=1.008v+12.94$
A5	V	Battery voltage	$y=2v+8.72$
A6	W	VHF PA output power	$y=0.05v^3+0.531v^2+0.25v$
A7	V	Primary bus voltage	$y=7.152v$
A8	I	VHF PA current (10 V)	$y=0.365v+0.149$
A9	I	VHF PA current (26 V)	$y=0.365v+0.149$
A11	V	RSSI voltage TC channel	$y=v$
A13	I	Primary bus current	$y=0.619v+0.019$
A15	V	First VHF PA voltage	$y=9v$
A17	I	Solar generator current	$y=0.573v$
A18	I	DC-DC cnvtr. in. current	$y=0.256v+0.02$
A19	I	Shunt regulator current	$y=0.669v-0.185$
A21	I	Battery load current	$y=0.174v-0.027$
A22	T	Battery temperature	$y=14v$
A23	T	Solar generator #1 temp	$y=-0.679033v^5+9.57784v^4-51.2412v^3+127.622v^2-170.345v+97.7918$
A24	T	Solar generator #5 temp.	$y=-0.679033v^5+9.57784v^4-51.2412v^3+127.622v^2-170.345v+97.7918$
A38	V	Fifth bat. element vltg.	$y=0.982v+3.258$
A42	T	Plateau temperature	$y=-0.337702v^5+4.60193v^4-25.4481v^3+71.3428v^2-119.362v+109.681$
A44	T	Shunt regulator temp.	$y=-0.337702v^5+4.60193v^4-25.4481v^3+71.3428v^2-119.362v+109.681$
A46	T	Solar generator #3 temp.	$y=-0.771085v^5+10.2258v^4-51.6250v^3+123.311v^2-154.219v+62.7882$
A48	T	Electro. gates 5-6 temp.	$y=-0.337702v^5+4.60193v^4-25.4481v^3+71.3428v^2-119.362v+109.681$
A53	P	Nitrogen tank pressure	$y=69.463v$
A54	T	VHF PA temperature	$y=-0.337702v^5+4.60193v^4-25.4481v^3+71.3428v^2-119.362v+109.681$
A55	T	Nitrogen tank #4 temp.	$y=-0.337702v^5+4.60193v^4-25.4481v^3+71.3428v^2-119.362v+109.681$
A58	V	RSSI voltage channel 1	$y=v$
A60	V	RSSI voltage channel 2	$y=v$
A62	V	RSSI voltage channel 3	$y=v$
A69	T	Nitrogen tank #1 temp.	$y=-0.337702v^5+4.60193v^4-25.4481v^3+71.3428v^2-119.362v+109.681$
A71	V	Dosimetre 5 experiment	$y=v$

Table 2. ARSENE analog telemetry decoding equations from F6BVP. The telemetry value of each channel is between 0-255. This corresponds to a voltage "v" between 0-5 volts. The real value "y" of measured parameters is calculated from the formulas.

Mode	Uplink	Downlink	Signal Type
B	435.050	145.975	AX.25 AFSK FM
	435.100	"	"
	435.150	"	"
S	435.110	2446.540	Any analog—up to 16 kHz wide

Table 1. Frequency plan for ARSENE.

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Restoring the Classics

It only takes one hamfest to learn an elementary truth: Such events are games of musical junk. That is, people trade favorite or despised rigs and equipment of earlier times for other people's favorite or despised rigs of other times. And, in some cases, spouses cast a wary eye on all that wonderful stuff coming in the back door after every hamfest.

Well, why not put some of that equipment back on the air? I mean it—after all, we don't all need to use a multikilobuck Super Bandbuster IV SSB transceiver with its Flaming Blowtorch 2000 linear amplifier. Besides the ham who simply cannot afford such things (as I was when I was a kid), there are also hams who can afford the Blowtorch and Bandbuster, but who like to work on supposedly antique radios.

Because my electronics experience spans both the vacuum tube era and the solid-state era (which is continuing, of course), I find myself at home with a variety of equipment. If you are not, and want to learn some basic tube theory, then look at any of the earlier editions of *The Radio Amateur's Handbook* or, if you will permit a commercial plug, see

my antique radio book from TAB Books in Blue Ridge Summit, Pennsylvania (phone: 1-800-233-1128).

Two pieces from my own collection of radio paraphernalia include the Heathkit DX-60B transmitter and the Hallicrafters SX-100 shown in Photo A. These two pieces of equipment would have made a real dandy Novice and General class station in the late 1950s or early 1960s.

What to Look For

There are several generic things that need to be done on nearly all vacuum era refurb jobs. First, if possible test all of the tubes. This might not be possible, even though at one time nearly every drug store and fast-food joint had a tube tester. Today, only older TV shops and antique radio repairers have them. If this isn't possible, then check the radio for

operation and troubleshoot to find weak stages and so forth. My antique radio book gives info on how this job is done.

Next, inspect the chassis, looking for signs of trouble. Look in the vicinity of the power transformers for signs of tar or pitch oozing out. This does not automatically mean that the transformer is bad, but it does tell you that it has been overheated at some point in its career. Note the condition and attempt later to find out whether or not the transformer is good.

Also examine the electrolytic capacitors in the rig (see Photo B). These components tend to dry out over time, and may have to be "reconditioned" or replaced. Reconditioning is done by letting the set work for a couple of hours a day for about a week. On radio receivers that have been stored for many years you may find a high hum level in the output. This symptom indicates that the electrolytic capacitors used in the DC power supply ripple filter are bad. Some of them will reform after being used for a dozen

or so hours. I once "reconditioned" a Hammarlund HQ-145 by letting it run for a week or so. The hum level dropped every day, and finally disappeared before the week was up.

The signs to look for on the electrolytic, indicating replacement, are discoloration of the paper (if tubular), bulging (all types), or any oozing of material at the end caps (all types). In most cases, the oozing will be long over and only a gray, white or tan corrosion or dust remains. If you see this material, replace the electrolytic capacitor. Don't even try to refurbish it.

The general rule of thumb for replacing an electrolytic, especially one in the DC power supply, is that you can use one with the same or higher capacitance rating, or the same or higher Working Voltage DC (i.e. WVDC) rating. If the capacitor appears to be bulged, then suspect that a higher WVDC rating is needed for the replacement. Measure the normal voltage across the capacitor and

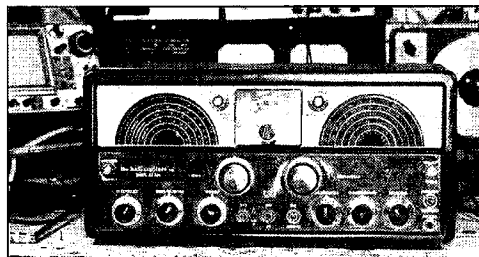
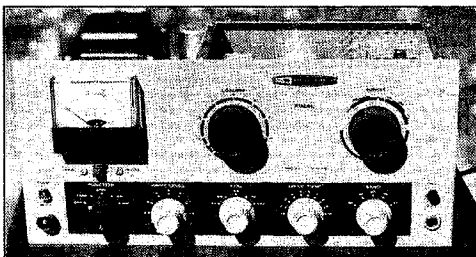
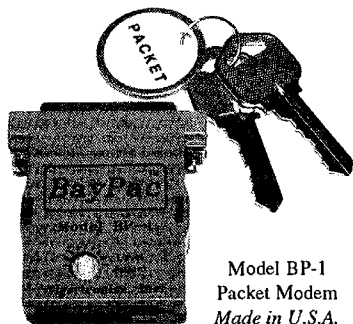


Photo A. The Heathkit DX-60B transmitter (left) and the Hallicrafters SX-100 receiver (right).

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then multiply it by 1.20 (this allows a 20 percent margin for error and variation). Next, multiply the WVDC rating of the existing capacitor by 0.80 (also allowing for a 20 percent margin). If the voltage times 1.2 is near (or higher than) the WVDC rating of the capacitor, then opt for the next higher value.

I've seen this problem several times where 350 WVDC capacitors were used in a receiver that should have used 450 WVDC. I recall a medical oscilloscope used for bedside monitoring in hospitals a couple of decades ago. It had a 270-volt DC power supply that used 60 μ F/350 WVDC capacitors in the two sides. They were typically found bulged out after a year or so in service. Note that $1.2 \times 270 = 324$ volts, and that $0.80 \times 350 \text{ WVDC} = 280$ volts. Get the point: Under the worst case, which apparently occurred from time to time, we have a 280-volt capacitor in a 324-volt circuit! With 20 or so of those 'scopes in our system, we were replacing electrolytics on a fairly regular basis. While this scenario is a bit extreme, it does happen. We replaced the capacitors with 60 μ F/450 WVDC units and never had another failure.

Some receivers use a multisection electrolytic capacitor. These capacitors sit upright on the chassis, and may have either two, three or four electrolytic capacitors in a single metal can (although it might have a paper insulating cover over it). All sections share a single common ground connection, which is the case of

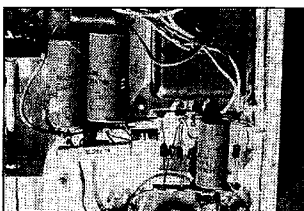


Photo B. Power supply electrolytic filter capacitors are often bad after storage, even when they were good when the rig was first placed in storage.

the can. Some old-timers would replace an open-circuited section (a fairly common failure mechanism) by shunting a tubular electrolytic across the bad section. This saves the replacement job, and is cheaper than buying the entire multisection electrolytic capacitor. Like many such "solutions," however, it is simple, elegant, easy and utterly stupid. In other words, it's wrong. Why? Because those electrolytics tend to fail later by shorting out. I've seen that happen so many times that I tend to get curmudgeonly and short-tempered when I see it. Besides, in those years when I worked on medical instruments I saw one case where such a repair might have cost a patient's life. A contractor (not one of us in the hospital lab, thank God) had pulled that trick on a defibrillator, and then the main capacitor shorted. When the patient went into ventricular fibrillation, the docs tried to use the instrument, and it failed. Fortunately, there was one nearby on another unit

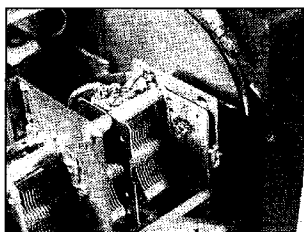


Photo C. Capacitor bearing and rotor ground are often sites of problems in older receivers.

and it was brought to the scene post haste . . . but time was wasted. We'll never know whether proper repair procedures would've saved that life, but I know I'll never be party to such a shabby repair. Such are the lessons of life.

Another thing to check is the condition of the switches and potentiometers in the set. Use switch contact or TV tuner cleaner to spray down each switch, especially rotary types, and each potentiometer. Get the stuff inside the component, and then mechanically operate the switch/pot vigorously eight to 10 times to thoroughly clean the insides. I've found antique bandswitches so corroded that only gentle rubbing with a pencil eraser did the trick. Be careful, especially on bandswitches, to not disturb surrounding circuitry.

On receivers of old you will find a massive main tuning capacitor, a multi-sectioned marvel of an air dielectric variable. Wonderful sight, those were! How-

ever, they are also a pain in the neck after 10 or 20 years of unuse. The front and rear bearings supporting the rotor plates are lubricated. The lubricant dries out with time. In addition, there is a ground spring that connects the rotor plates to the capacitor frame. These (usually brass) springs are the electrical connection. If the receiver intermittently howls and screams when tuned, or is excessively microphonic (howls or screams when touched or vibrated), then suspect either the lubricant or the spring.

The lubricant can be cleaned out with spray cleaner, but be sure not to spray the plates. Be gentle with the spritzer button! Replace the lubricant with white petroleum grease such as LubriPlate, or something similar. Some people claim that silicone grease works as well, but I haven't used it so I can't corroborate the claim. Use a toothpick to apply the grease, and then run the capacitor through its entire range several times.

The ground spring needs to be cleaned, especially under the tip that rests on the capacitor mounting plate. Gently raise it—but not too far—and burnish the metal underneath it and on its bottom side. This trick should reground the capacitor and make the radio work again.

Of course, there may be other problems, and they will require normal troubleshooting procedures to find. Those mentioned above are often due to old age or the abuse of nonuse. 73

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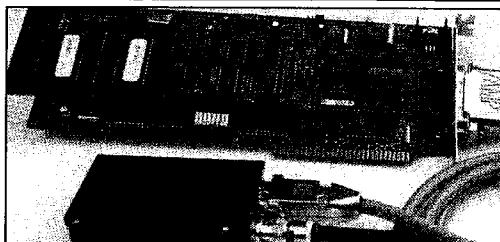
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with 30 watts on 70 cm to a 10 dB gain antenna. For the downlink, a GaAsFET preamp and a 2.5-foot dish with coffee-can feed should work.

Mode B will be the most common ARSENE activity. The link margin on the uplink will be the same as Mode S, but due to congestion, it may seem to take much more power at times when the satellite is visible to many users. The high-power 15 watt downlink on 2 meters will be an easy copy on a moderate beam at a home sta-

tion. While signals may be audible on portable equipment with omnidirectional antennas, the packet copy will likely be poor. Since the orbit is quite high even at perigee, there will be no times when the signals will be overwhelming. They will, however, be consistent and show very little Doppler shift.

The French telecom authorities have assigned ARSENE the call sign FX0ARS. Satellite builders have decided to label the AX.25 frames with

ARSENE-1, ARSENE-2 and ARSENE-3, depending on which TNC is transmitting. After launch ARSENE will retain its prelaunch name, although there will be no problem with other international groups that may decide to assign an OSCAR number. Depending on the launch status of other hamsats currently waiting for launch, ARSENE may become known as ARSENE-OSCAR-24 or ARSENE-OSCAR-25.

ARSENE Telemetry

The single 2 meter downlink frequency will carry telemetry information as well as the digipeated packet activity. The data downlink carries information on 30 analog channels and nine satellite status bytes. The format will be unconnected AX.25 frames. Table 2 shows information on the analog telemetry equations as received from Bernard Pidoux F6BVP via Joe Kasser G3ZCZ/W3. Note that the parameter value is denoted by "y" and the variable "v" is the value sent from the satellite to be used in the appropriate equation. The "Units" column shows the type of measurement for the channel where "V" is voltage in Volts, "I" is current in amps, "T" is temperature in degrees Celsius, "P" is pressure in Bars and "W" is power in watts.

The nine digital-format status

bytes include two eight-bit bytes STA and STB that describe the status of 16 on-board systems. Table 3 shows the breakdown of this information. The other seven status bytes include four for message handling and three that represent counter information.

A shareware program (PC) written by FC1OAT to decode telemetry on-line is available from ATEPRA (Association Technique pour l'Experimentation du Packet Radio Amateur), 23 rue de Provins, F-77520 MONS EN MONTOIS, France, Europe. It is compatible with CGA, EGA or VGA displays and requires only the addition of a receiver tuned to 145.975 MHz FM, a standard TNC and an antenna.

Get Ready

ARSENE promises to be an exciting satellite. Its curious orbit and standard packet system set it apart from any other hamsat available for use by all hams. Congestion is expected after this satellite is "discovered" by the ham community. Expect announcements concerning the use of the three uplinks to segregate individual operators, bulletin-board systems and packet clusters. Also expect more emphasis on Mode S operation to get on this satellite and get ready for Phase 3 D later this decade.

ARSENE DIGITAL TELEMETRY FORMAT

Word	Bit	Module	State=1	State=0
STA	ST1	TNC 1	On	Off
STA	ST2	TNC 2	On	Off
STA	ST3	TNC 3	On	Off
STA	ST4	VHF xmit	CIM TLM	Packet
STA	ST5	VHF pwr.	Low	Normal
STA	ST6	Exp. sply.	On	Off
STA	ST7			
STA	ST8	Squelch	Off	On
STB	ST9	Bat. reg.	On	Off
STB	ST10	OK to load bat	Yes	No
STB	ST11	Bat. load mode	Normal	Housekeeping
STB	ST12	Packet xpndr.	On	Off
STB	ST13	Mode B or S	B packet	S linear
STB	ST14	10V pwr. sply.	On	Off
STB	ST15	Hi pres. gates	Open	Closed
STB	ST16	ACS pwr. sply.	On	Off

Table 3. Significance of digital telemetry bits in words STA and STB of ARSENE's nine digital telemetry status bytes.

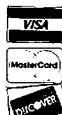


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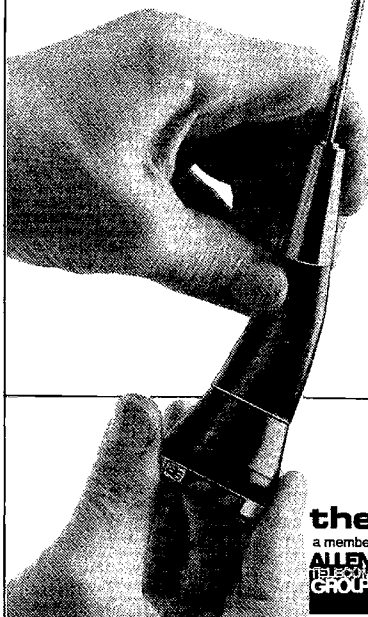
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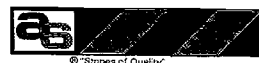
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I had hoped to present the first part of my solar charge controller this month but, because of several circuit changes, the PC board has to be re-worked and there will be a delay. This is a rather complex circuit so I'll show the charge controller in stages as we go.

The first part of the project will deal with the power supply and the voltage reference, as well as the state of the charge circuits. I'll show you the basic design for the voltage divider used for the battery sense line as well as the array detect circuits.

Power to operate the controller comes from the battery being charged. A 1N4001 diode provides reverse polarity protection for the ICs. The input to the first voltage regulator is decoupled with several low value capacitors. This keeps the IC regulator stable since the supply voltage (the battery) is located some distance from the regulator itself.

A 7812 IC regulator provides a stable +12 volts for the controller. The normal battery voltage will be around 12.6 volts so there will not be enough overhead to allow this regulator to work properly. When the battery voltage is 12.6 volts, the output of the regulator will be about 10.5 volts. When the input to the regulator is approximately 1.5 volts over the minimum needed, the regulator will work properly. When the battery is nearing full charge (14.4 volts), the regulator will have enough overhead and will output its required 12 volts.

If you have a problem with this system you may swap out the 7812 for a 7810 regulator. This is a 10-volt regulator and will work fine on a 12.6-volt

Low Power Operation

battery. They are much harder to find than the 7812, though. However, all the major electronic suppliers do stock the 7810. Radio Shack does not handle this part, but it does carry the 7812.

The output of the regulator supplies VCC to all the ICs. The output also supplies the LM317L regulator. This regulator is a small TO-92 case version of the popular LM317 TO-220 case regulator. A 10-turn 1k trimmer sets the voltage at 4.5 volts. Op amp U2 is configured as a buffer. This buffer provides isolation between the logic and the 4.5-volt reference source. The output is on pin #7. This then becomes our 4.5-volt reference line. The reference line connects to several points on the PC board. If you're building this circuit on perf board, don't forget to connect all these reference lines together.

To generate our state of charge reference voltage, another op amp is used, but this time as a voltage amplifier. The 22.6k 1 percent resistor sets the gain of the amplifier in conjunction with the 0.01 capacitor. The state of charge is then set by adjusting the 470k pot. By increasing the amount of resistance in the circuit you increase the output voltage from the op amp. This then becomes our SOC reference source.

Array detect works by sampling the voltage generated from the array. A voltage comparator made up of an op amp compares the output of the array to the voltage on the battery. If the array voltage is lower than the battery voltage, then the comparator's output stays high. When the array voltage is greater than the battery voltage, meaning the array will be able to charge the battery, two things happen: First, the array ready LED is illuminated; second, the charging LED is also illuminated,

indicating battery charging has begun.

Since this controller uses power MOSFETs, even when they are "off" their internal clamping diode will allow the battery to discharge at night. A Schottky barrier diode in series with the MOSFETs and the battery prevents discharge at night. It also isolates the battery from the array, allowing the array detect comparator to see only the array and not the battery voltage at the same time.

The Schottky diode is an MBR1635. This TO-220 case diode will allow current to 15 amps if the device is properly heat-sinked. You will have to de-rate the device if you don't heat-sink it properly.

Because the case of the MBR1635 is electrically hot, you must use the necessary TO-220 mounting hardware. If you don't choose this route, then insulate the heat sink from the rest of the project. Of course, you may use a different type of blocking diode for the project. I used a DO-40 stud mount diode in one of the prototypes. I mounted this diode, as well as four IRFZ40 power MOSFETs, to a 4" x 6" x 1/8" aluminum sheet. Since the case of the diode and the drain of the MOSFET are connected by the same heat sink, the entire heat sink had to be isolated from the rest of the circuitry. Although this makes it harder to mount the heat sink, it also makes it much easier to connect the blocking diode and the FETs. With the arrangement mentioned above, I have a current capacity of 45 amps!

That's about all the space I have for this project this month. Next month we'll look at a classic transmitter with a few new touches added. After I correct the final PC boards I'll pick up again with the solar charger.

Super RIT Update

I received word from Rulon Vandyke KA7BCD on a correction for the article "Super RIT for the HW-8." This modification first appeared in the

April 1990 issue of the QRP Quarterly.

There seems to be an error in one of the resistors controlling the bias on a transistor switch. With the values shown in the original, you'll not be able to get the circuit to operate.

The transistor bias resistor R6 should be a 330k-ohm one instead of the crippling 3.3k-ohm one indicated in the schematic and parts list. Proper transmit bias voltages cannot be achieved at the collector of Q1 with such a low value of base resistance. This low resistance changes the R3VR2 voltage divider ratio by effectively adding a low resistance in parallel with VR2.

Since this circuit appeared in many different publications, including the *HW-8 Handbook*, Rulon asked me to let the readers of the "QRP" column in on this correction. So, tell your friends and fellow HW-8 modifiers about this correction to the Super RIT for the HW-8.

Dayton '93 Hamvention

There is some good news and some bad news concerning the QRP get-together this year at Dayton. First, the bad news is that the Knights Inn is no longer in business. Hard economic times did the hotel in. The good news is that we have a block of 50 rooms at the Day's Inn South! This is the same place the QRP ARCI held their first Dayton meeting. Like the buzzards coming home to roost in Hinkley, we've come home.

The room rate is \$75 per night (that's with our discount because the club has a 50-room block). There is no restriction on the number of people you can have in the room.

If you want to stay with the QRP ARCI this Dayton '93, drop a note to Myron Koyle N8DHT at 1101 Miles Avenue, Canton OH 44710, or call him at (216) 477-5717 for more information. You'll need to send in a check for one night's stay (\$75) and make the check out to Day's Inn Dayton South. Hope to see you there!

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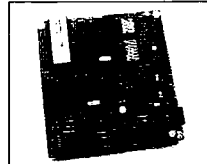
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Radio Direction Finding

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Portable computer technology is astounding. Isn't it? My first, a Sinclair ZX-80, amazed me. But it seems primitive next to today's laptops and notebooks. Unless you already have one of the newest of these little marvels, I'll bet you're looking for a good excuse to acquire one.

If your ham radio activities include radio direction finding (RDF), you can put your laptop to work. My last two columns told you how WB8WFK uses one to get more accurate bearings on hidden transmitter hunts, sometimes called foxhunts or T-hunts. This month we'll move on to some new ideas in computerized triangulation.

Trigonometry Without Tears

Competitive mobile T-hunts pit individuals or teams against one another. Rules forbid collaboration between teams and assistance from base stations. Clues of any kind are a big no-no.

However, there are times when RDFers can and should work together. Search and rescue hunts go faster when the participants share information. It's much easier to pinpoint a jammer or bootlegger when several widely scattered teams com-

pare their bearings.

From a single location, you can determine the azimuth of an incoming signal with fair accuracy, but you can only guess the distance, based on the strength of the signal. When azimuth information is available from two or more properly-spaced locations, the intersection of the lines of bearing tells not only the direction of the T but the distance to it. The process of determining this intersection is called "triangulation." Since this term comes from the word "triangle," you might get the idea that three stations or bearing-taking locations are required. Actually, only two are needed. Two lines of bearing plus a line drawn between the stations forms a triangle. In addition, right triangles are created when you intersect the bearing lines with north-south and east-west grid lines.

If bearings are accurately taken and the signal has followed a direct path to the observer, the intersection will be the location of the signal source. Of course, conditions are seldom ideal. Buildings, hills and mountains reflect VHF signals, causing bearing inaccuracies.

The pattern of an RDF beam or quad can be skewed, due to non-symmetrical construction. It can be affected by the vehicle or nearby objects. Your compass reading can be thrown off by a local magnetic disturbance as you sight along your antenna boom for a bearing.

To counteract these effects, it's



Photo A. Tim Mofitt NØNXI (left) and Paul Temlund WB3JZV use a Macintosh PowerBook computer for triangulating. They live near Denver, so they are used to T-hunting in cold weather. (Photo by Stephen Temlund.)

best to take lots of bearings, perform lots of triangulations, and average the results, throwing out the wildest of the individual fixes.

The usual procedure for triangulation involves drawing lines on a map using a protractor and straightedge. You can cross two lines on a map quickly, but when there are many reporting stations and many bearings the map becomes a confusing jumble of points and lines. Here's where digital technology can speed things up and improve accuracy.

In recent years several hams, including WD8CBE, N6JSX, and yours truly, have written RDF programs for various computers. They feature triangulation from stations at pre-programmed locations, telling the user how far he is from the predicted T-location, plus which way and how far to drive to get there.

Listings for two such programs (DF2.BAS and DF3.BAS), along with a detailed explanation of triangulation theory and equations, are in Chapter

20 of the book *Transmitter Hunting—Radio Direction Finding Simplified* by KØOV and WB6UZZ, available from Uncle Wayne's Bookstore. The programs are in BASIC-80 and can be readily adapted to almost any computer, even my old ZX-80.

Don Lewis KF6GQ has written a special program for cooperative hunts in Southern California. It runs on PCs with VGA graphics and includes a built-in map of the Los Angeles region in the display. Send an SASE to Don (543 Bradbury Road, Monrovia CA 91016) for more information on THUNT91A.EXE.

Something New from the Mile-High City

Most RDF programs declare the hidden transmitter's location one fix at a time. What happens when there are three, four, or a dozen stations taking bearings from scattered locations at once? If you triangulate them all, two at a time, you will get many different fixes, due to inaccuracies in each bearing. Which fix is best?

In the T-hunt book, I mentioned that an advanced RDF program could average the results of multiple bearings to give a refined estimate of the T's location. It could also compare the performance of each bearing-taker, based on this result. KF6GQ's program can average up to 10 bearings at a

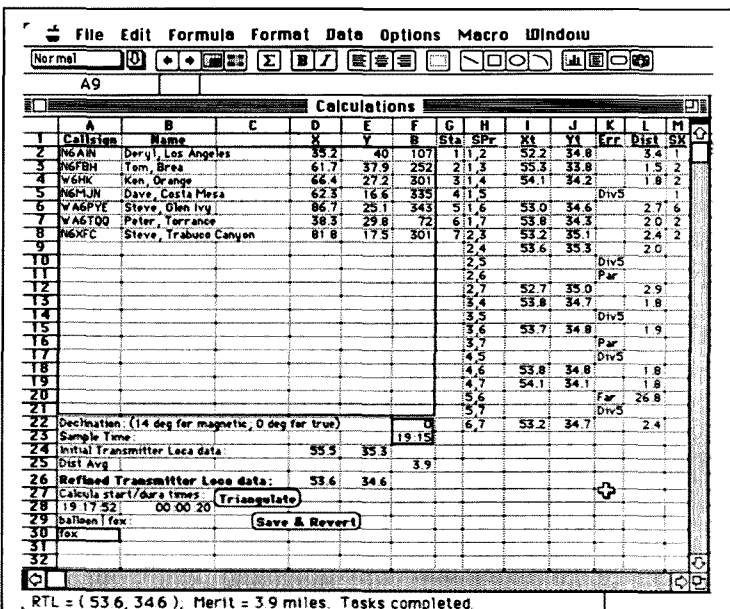


Figure 1. Bearing and location data is typed into the bordered area of the Calculations spreadsheet (cells A2 through F21). The computer triangulates the bearings in pairs and displays the results in other cells.

time, but it is limited to the Los Angeles area.

A more general program with many additional features has been developed by Paul Ternlund WB3JZV. He is an engineer and computer scientist with the Department of Defense, living in Aurora, Colorado. His favorite ham radio activities include foxhunting and tracking ATV balloons.

"I'm a nut for accurate bearings," Paul says. "I'm trying to get a practical understanding of 2 meter bearing-taking and all the phenomena that go with it. When I'm the fox on Denver's competitive hunts I ask hunters to give their bearings to me as they hunt, and I give bonus points for the best ones." A program for calculating and displaying multiple bearings must have fast math functions, sophisticated plotting routines, and a tabular user interface. Paul's T-hunt partner, Tim Moffitt N0NXI, suggested using Microsoft® Excel instead of creating a complete executable application.

Paul wrote a set of macros that accept bearing data from up to 20 RDFers, triangulate each pair, detect and throw away "wild" fixes, average the good fixes to give a best guess of the T's location, and more. The results appear in just a few seconds on a PowerBook or other Macintosh computer. (The routines should also work on the PC version of Excel, but Paul has not verified this.) WB3JZV's algorithm deduces the predicted T location using double averaging. To show how it weeds out the bad bearings, let's go through a hypothetical cooperative hunt. Assume that it's just after dinner time and a continuous carrier has appeared on a popular packet frequency in the Los Angeles basin, blocking all message forwarding.

Another Stuck TNC

Several T-hunters get together on a voice repeater. All have a good direct signal from the QRMing station at their homes except for WA6PYE. Steve's house is blocked from the signal source by the Chino Hills and the Santa Ana Mountains. He doesn't realize it, but the signal is getting to him by reflecting off Mount Baldy in the San Gabriel Mountains to his northwest.

Each station reports antenna heading in degrees azimuth and location, given as coordinates on an agreed-upon map. This group uses the AAA Los Angeles County and Vicinity map, marked with a grid of one-mile squares. The one-mile lines are numbered in ascending order to the north and east, beginning with zero in the lower left corner.

You are the search coordinator, so you start Excel and load Fast-Workspace to begin the triangulation process. This opens the Calculations spreadsheet (Figure 1) and some other files that will be described later. You type in the callsign, name and

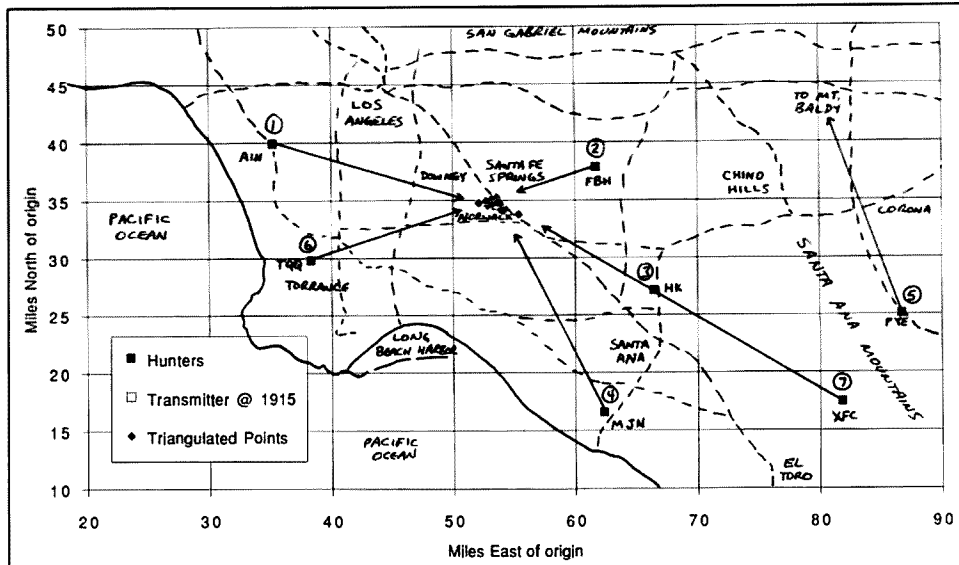


Figure 2. After triangulations are complete, WB3JZV's program produces an Excel chart of the hunters and their fixes on the fox. In this case, the final position estimate is almost buried under them. I drew in the coastline (solid) and major freeways (dashed) for reference.

city (optional), location coordinates (X and Y), and bearing (B) for each reporting station. A mouse-click of the Triangulate button near the bottom of the spreadsheet starts the computations.

First the program assigns each station a number, shown in the "Sta" column. Then it triangulates each pair of bearings and displays the outcomes in the "SPr," "Xt," and "Yt" columns. W6HK and N6XFC each gave a bearing of 301 degrees. Parallel bearings do not intersect, so the program puts "Par" in the error ("Err") column for station pair 2,6.

Bearings of WA6TQQ and N6FBH differ by exactly 180 degrees; thus bearing pair 3,7 cannot be triangulated and a "Par" error is displayed. WA6PYE's reflected bearing diverges from bearings of all stations except WA6TQQ. The program displays a "Div" error in these cases.

The macro averages the "Xt" and "Yt" values of all fixes to give a preliminary position estimate. Then it calculates the distances from this preliminary position to each of the fixes, displaying them in the "Dist" column. Next it scans the distances, looking for fixes that are at greater-than-average distance from the preliminary position estimate. In this case, the intersection of WA6PYE's Baldy bounce bearing with WA6TQQ's bearing was almost 27 miles away from the main cluster, so the program discards this fix and displays a "Far" error for pair 5,6.

The macro averages the surviving fixes to get a final position estimate, which it displays in line 26 and the status bar at the bottom of the window. You mark this point on the AAA map to see where it is.

Meanwhile, Excel generates a scatter chart showing the hunters, the surviving fixes, and the final posi-

GLOSSARY

Azimuth—Astronomical term for angular degrees measured in a clockwise direction from true north. For example, east is azimuth 90 degrees.

Bearing—In RDF, the compass direction of an incoming radio signal as observed by a receiving station. True bearings are taken in degrees relative to true north, while magnetic bearings are relative to the earth's magnetic North Pole.

Triangulation—RDF technique for determining the position of an unknown emitter by trigonometry, using bearings taken from two or more known locations.

Fix—The position determined by triangulation from bearings taken at two points.

Spreadsheet—A grid of cells containing numbers, formulas, and labels (see Figure 1). Spreadsheet computer programs such as Microsoft® Excel are used to enter data, calculate results, and display in tabular and graphic form.

Macro—A computer file containing a set of formulas to direct a sequence of actions, such as choosing commands, entering formulas, and performing calculations. Excel uses macros to carry out complex operations on data in spreadsheets.

tion estimate (Figure 2). Excel automatically selects the area of display and scales of the X and Y axes, but you can change them manually if you wish.

Let's Roll

MacroFast has reduced the search zone for our hypothetical stuck carrier to a small area just northwest of the intersection of Carmenita and Rosecrans in the city of Santa Fe Springs. That's the best estimate we can expect from triangulation methods when the nearest RDFer is over eight miles away. Now it's time to send in the mobiles.

From Figure 2, it's clear that the fastest way to end the QRM will be to phone T-hunters in the connecting cities of Santa Fe Springs, Norwalk, and Downey. If none are available, and a choice must be made from stations in this RDF net, it looks like W6HK can get to the

scene fastest. He is farther away than N6FBH, but he is close to a freeway that goes directly toward the target intersection.

Although not needed in this case, you can quickly update the position estimate when additional observers check in. Just add the next bearing on row 9 of the Calculations spreadsheet, click the Triangulate button again, and MacroFast will recalculate and redisplay the scatter chart. The program can crunch up to 20 bearing reports at a time.

WB3JZV's file set is excellent for coordinating the search for a stuck transmitter or jammer, but Paul designed it for a more ambitious purpose—recovering ATV balloons. Next month's "Homing In" column will show you how the system tracks moving signals, develops a figure of merit for the position estimate, and grades the performance of each hunter.

PACKET & COMPUTERS

Number 17 on your Feedback card

Jeffrey Sloman N1EWO
75 Herriott Street
Franklin IN 46131

Understanding Asynchronous Communications

It will come as no surprise that the most common roadblock to setting up a packet station is making the connections among the components. The connection between the radio and TNC (Terminal Node Controller), and from the TNC to the terminal, can have you pulling your hair out if they don't work as expected. This month we'll take a look at the TNC-to-computer link (Part 1 of 3). The series will cover both communications hardware and software. I will focus on the IBM-PC because that is the overwhelming choice for use in ham radio. If you don't use a PC, don't stop reading—the principles discussed are true of all computers/terminals, only some details will be different.

All Your Bits in a Row

The communication between your TNC and terminal is called a *serial* connection. It gets its name from the way the data is transmitted. The fundamental particle of data is called a *bit*. Bits can have one of only two values: 0 or 1. In a manner not unlike Morse code, bits are transmitted in groups, each distinct group assigned a value. For example, in the most commonly used code—called ASCII, for American Standard Code for Information Interchange—the string of bits:

1100101

stands for a lower case "e." The serial connection between the TNC and terminal sends one bit at a time—serially—and so gets its name from this behavior. The alternative to this is called parallel data transmission. This technique is faster because it uses more than one data line to transmit the information. Each bit in the code gets its own data line and the entire code can be sent in one move. The most common place to find this technique is printer connections. The Centronics parallel interface is the standard in the PC world and, because of this, on many other computers as well. Most parallel connections have eight data lines, and so are able to pass data eight bits—called a byte—at a time. This is because most communications codes use the byte as the basic character size. There are exceptions to this. For example, because of the large number of characters, Japanese codes use 16 bits (two bytes) to get more combinations.

Some programs which use the parallel port for bidirectional communications—such as file transfer programs like Lap-Link—overcome the unidirectional nature of most PC parallel ports by transmitting the data on the printer status lines. These are the connections the printer uses to say it is ready,

or out of paper. Because there are only four of these, data is sent a *nybble* at a time. Yes, you guessed it, a nybble is a half-byte (4 bits).

RS-232D

The serial port on your PC follows a standard called RS-232D. This standard describes the signal lines, and to which connector pin they are assigned. Strangely, it does not specify a connector type, but the 25-pin D connector is the de facto standard. There are 25 defined pins in the RS-232 standard. Amazingly enough, you may only need three of them.

The three workhorse pins in the RS-232 connector are:

- 2 (TD) Transmit Data
- 3 (RD) Receive Data
- 7 (SG) Signal Ground

As you can see from the list, an RS-232 connection can be very simple: someplace to send the data, someplace to get the data, and a common ground. If this works, why bother with 25 pins?

Handshaking

In a perfect world, the receiver would be ready to receive whenever the sender was ready to send. Your own real-world experience will tell you, though, that the word "standby" is very useful. Digital communications is no different, and it is often the case that the data flow must be interrupted. This is called *flow control* or *handshaking*. The RS-232 spec defines several status lines that are variously used for "hardware" handshaking:

- 4 (RTS) Request to Send
- 5 (CTS) Clear to Send
- 6 (DSR) Data Set Ready
- 8 (DCD) Data Carrier Detect
- 20 (DTR) Data Terminal Ready

These handshaking lines can be used in many ways, but the most common is the RTS/CTS combination. But what about our three-wire setup?

The three-wire connection provides only enough wires to get data to and from the terminal and DCE. This means that handshaking must take the form of *software flow control*. The standard form of software flow control is called XON/XOFF protocol. To understand why, and how it works, we have to take a look at ASCII code again.

When transmitting data, it is often necessary to send some information concerning the connection itself. In the case of flow control, we want to stop and start the data stream. How can we do this? Well, we could send STOP! every time we wanted to stop it, and START! to get it going again. The trouble with this approach becomes apparent when we decide to send STOP! or START! as part of the message text itself. Well, you say, I'll probably never want to send that anyway, so I'll just "reserve" it as a command. You can't send it as part of a message, and

that's that.

Well, this would work, but it would be very cumbersome. If we get a little clever we can reserve a single character, say "\." Then if "\." appears in the data stream, whatever follows should be interpreted as a command. This technique is known as an *escape* character, and is actually used, though not for flow control. While either of these techniques could get the job done, the designers of ASCII came up with a more transparent scheme. They reserved the first 31 codes as *control characters*. Yup, these are the codes that are generated when you hold down the control key and type a character. These characters need never be part of the text, and so can be immediately interpreted.

Each of the control characters has a name and function. Some of them have fallen into disuse, but there are a few of interest:

Character	ASCII	Function
CTRL+G	07	BEL (rings terminal bell)
CTRL+H	08	BS (backspace)
CTRL+I	09	HT (tab—the H is for horizontal)
CTRL+J	10	LF (line feed)
CTRL+L	12	FF (form feed—clears the screen)
CTRL+M	13	CR (carriage return)
CTRL+Q	17	XON (starts data flow—also called DC1)
CTRL+S	19	XOFF (stops data flow—also called DC3)

As you can see, most of the control characters perform familiar functions. You are probably used to hitting the backspace key to backspace, but you can experiment with CTRL+H—you'll see that it works. The last two are the flow control characters. They are generically known as DC1 and DC3—DC means Device Control. When your terminal needs to stop the data flow it sends CTRL+S to the DCE; to start it back up just takes a CTRL+Q. You can even do this manually.

Who's Who?

As you may have noticed, the RS-232 spec has a "point of view." That is, the connections are defined with one side as receiver and the other as sender. Of course, it is quite unusual to have a one-way data circuit—so what's the deal?

The individual data lines in RS-232 are not bidirectional—notice that there are separate send and receive lines. They are also complimentary—inputs must be matched to outputs. This leads to classes of equipment. Your computer or terminal is called DTE (for Data Terminal Equipment) while your TNC is known as DCE (for Data Circuit Terminating Equipment). The RS-232 spec is written from the DTE point of view.

Usually equipment to be connected to a data terminal—be it a computer or dumb terminal—such as a modem, TNC, or serial printer, is configured as DCE. This is not always the case, and is why there is such a thing as a *null modem cable*. A null modem cable

flips the complimentary lines over so the two like devices (DCE-to-DCE, or DTE-to-DTE) can communicate. In the practical world of packet stations, a standard modem cable—sometimes called a Hayes modem cable, after the company that pioneered telephone modems for PCs—does the job. This cable is wired to connect DTE to DCE, the "normal" case.

Technology Marches On . . .

The IBM-PC had a 25-pin D connector for serial communications, but only used nine of the pins (maximum) to make a connection. It didn't take long for IBM to decide this was a waste of pins, so with the introduction of the IBM-AT the connector was changed to a 9-pin D connector. While this was a good idea, the implementation left something to be desired. The nine pins—as defined by the RS-232 standard—used by an IBM serial port are 2,3,4,5,6,7,8,20, and 22. Now, it would seem obvious—at least to me—that the best course would be to leave pins 2 through 8 assigned to the respective pins on the DB-9 connector. I must be missing something, or maybe that was just too simple, because here is what IBM came up with:

DB9	DB25	Designation
1	8	DCD (Data Carrier Detect)
2	2	RD (Receive Data)
3	3	TD (Transmit Data)
4	20	DTR (Data Terminal Ready)
5	7	SG (Signal Ground)
6	6	DSR (Data Set Ready)
7	4	RTS (Request To Send)
8	5	CTS (Clear To Send)
9	22	RI (Ring Indicator)

This may be confusing, but we are stuck with it. In any case, as long as you know the pinout you can make a working cable—the signals are the same.

Why Asynchronous?

You have probably heard the term before, maybe in its shortened form of "async," but what does it mean? Async refers to the fact that characters sent over the connection will not necessarily arrive at any particular time. This is important because the receive station must somehow decode the incoming signal, and to do that it needs to know when the character starts and ends. This is where the notion of start and stop bits comes from. These allow the receiving equipment to determine the front and back of the transmitted characters. When you set your communications parameters to:

- 8 data bits
- no parity
- 1 stop bit

you are specifying the structure of each character sent. One stop bit will be sent—a start bit is always sent. The parity bit is used—or rather not used—for error detection. Though this is its intended purpose, it is rarely done.

I am going to stop here with Part 1. Part 2, next month, will finish this discussion—with the final installment cov-

Continued on page 50

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PACKET & COMPUTERS

Continued from page 48

ering software following that.

Survey Results

A couple of months ago I included a survey in the column. I have gotten quite a few responses (thanks to all who took the time), but I want to see if I can get more. So, those of you waiting breathlessly for the results of the survey—take a breath. To tease a little: You guys are overwhelmingly PC users, quite a few of you with heavy-duty machines! There is a strong interest in Internet connectivity, and in improved software for packet use. After more readers respond I will publish the results here. Below are the questions once again. Paper mail and email are both fine.

1. What is your callsign?
2. What is your license class?
3. What computer(s) do you use in the shack?
4. What operating system/environment version(s) do you use?
5. Which digital modes are you equipped for?
6. Which digital modes are you active in?
7. Which of these columns (month, year) has been your favorite (if any)?
8. What has been your biggest problem with computers in ham radio?
9. What would you like to see in this column?
10. Any comments:

You don't need to copy the questions, just put the number before your answer. Answer all the questions, or just the

ones you want. Make the responses wordy or brief. I really want your feedback to make this column something you look forward to each month. Thanks so much for your participation.

Electronic Addresses

Packet: N1EWO@NOARY

(note: I'd love to hear from you on packet—but not about the survey! This survey is the business of this magazine, and we can't do that on ham radio. A personal note or test message is just fine.)

Internet: jsloman@mcimail.com

(This is my preferred address.)

MCI Mail: jsloman

(This is the same as above, but direct.)

CompuServe: 71221,1143

(This is my least favorite place to get mail, but it is OK.)

Even if you don't answer any survey questions, I am very interested in anything you have to say. I can't answer every message—though email has a *much* better chance. Many of you have written asking for help. You have not been forgotten—I am planning a "mailbag" column for the near future where I can answer the many similar questions that come in. For those of you who have written saying that you enjoy the column, thanks. For those of you who would like to see additions/changes, please write to me—it's the only way I have of knowing what you need and want. 'Til next month, 73 de N1EWO.

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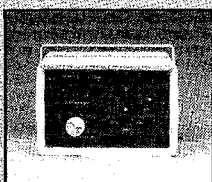
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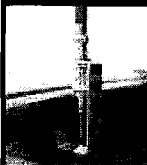
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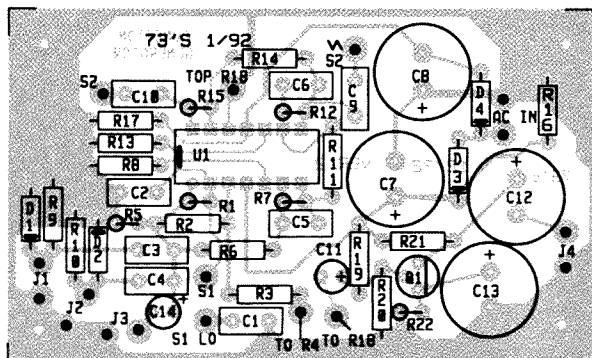
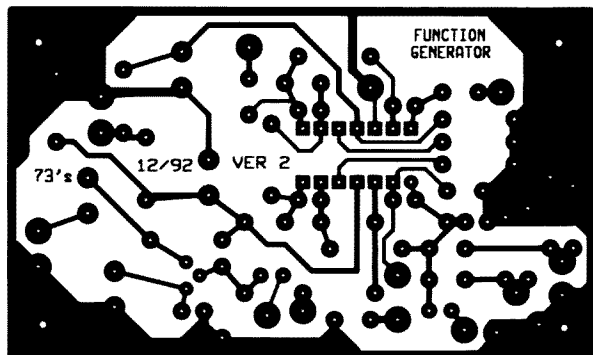
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Corrected PC board foil pattern and parts placement for the Function Generator, January 1992 issue.

Build a Function Generator

Refer to the above article in the January 1992 issue, page

28. A ground lead and a component (R16) were left off the original PC board. The intersection

of R18 and pin 3 of U1 should have been grounded. A new

ground trace has been added to the PC board.

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

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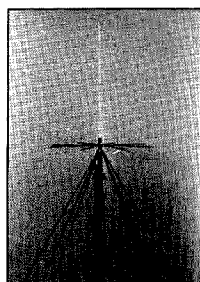
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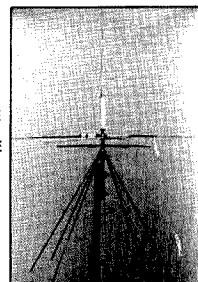
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RF Actuated Coaxial Switching

My desire for a coaxial switching circuit that would activate on the presence of very low level RF from low power SSB HTs started me off on a new project. This is the circuit that I mentioned last month in the narrative covering mobile operation on 10 GHz. This circuit was the output of a design effort to permit our 10 GHz converters to be switched on RF detection from the transmit IF, our 2 meter SSB HTs. These HTs have a low power output of about 100 mW. The circuit can be easily modified to accommodate higher power transceivers. More on that later.

The development of this unit was predicated on a coaxial switching system that operates on RF carrier detection, eliminating the need for manual RF switching. This manual switching involved multiple switching circuits controlling converters, preamplifiers, IF switching, and other switching relays that inserted the high power TWT amp on transmit. The addition of this new control circuitry would make our microwave rigs push-to-talk, a great improvement.

This switching system is not limited to low power configurations or to microwave operation. It can be adapted as you wish (it's a basic control circuit, not just for microwave) to handle higher powers and lower microwave frequencies. As a matter of fact, you could use it to control VHF converters as easily as my microwave systems. It is well-suited to custom installations and adaptable to various switching needs.

The Circuit

First, let's get into the circuit. It's quite simple and it evolved from several designs used for transmitter-actuated switched circuits, or "tranx" switch circuits. Some of the basic tranx circuits consist of a simple diode detector rectifying a small portion of the incoming RF to produce a controlling DC signal for control use. This DC voltage is usually applied to a Darlington transistor providing high gain and amplification, allowing a relay connected in its output to be activated on detection of transmit RF. See Figure 1.

This circuit does work, but has some limitations. One limitation is that most RF detection circuits assume you have a transmitter power of a few watts or so, allowing easy brute force detection to actuate the control circuit. Delicate operation is not one of its

traits. When we use a 2 meter transceiver as an IF system in our microwave converters, the higher powers are a detriment. This doesn't mean that they can't be used, but the extra power serves no purpose. If a higher power radio is used, most of the power output must be dissipated before being applied to any converter. Usually radios that provide 100 mW are desirable for converters as they will operate for long periods of time without requiring large battery packs.

In tests that I conducted, Darlington circuits proved to be very unreliable when switching multiple circuits in tests that I conducted. What was needed was a very sensitive circuit that would be reliable and not give false operations. A search through many pieces of literature produced many different approaches, but never seemed to hit the mark I wanted.

Part of the answer came from the *RSGB VHF Handbook*, fourth edition, chapter 6.3. They described just what we wanted: an op-amp-controlled, very sensitive RF-actuated detection circuit using two diodes and a 741 op amp. I built the circuit and was very impressed with its operation. It was so sensitive it would operate on key-up SSB without modulating the rig. I tried to make the circuit false (fail) but it operated very reliably. I was pleased with its high sensitivity and its ability to operate the keying circuit on SSB PTT without requiring modulation.

Improving the Circuit

The basic circuit designed by the RSGB group had one flaw: a switching transistor that is used for relay control. Up to this point I was looking at the output of the op amp for test results. This book was published in 1983 and the improvement I made was to incorporate components that were not available or were very expensive at that time.

The change or improvement is to replace the transistor with a power FET. This simple improvement made all the difference in the world in circuit operation. It speeded up switching times and made the circuit very easy to duplicate as the op amp can drive a FET easily. I used an "N" channel FET so that when the op amp did not detect RF its output would be negative,

or, switched towards the source of the FET, turning it hard off. When the op amp pin #3 went positive on RF detection its output would switch towards the positive rail, turning the FET's gate positive and on (see Figure 2).

The difference between a transistor and an FET in switching times is like comparing a Model T Ford to a Ferrari. The FET and Ferrari are both very fast. As a matter of fact, the FET can switch in the nanoseconds, something the transistor can't accomplish.

Now the switching and RF detection circuit were functioning well. The remaining circuitry that needed to be designed was the control switching and delay for the coaxial relays. This part of the circuit would do the actual control or receive and transmit switching and timing for our microwave converters. What we desired was some time control or delay to allow the RF preamplifier switching to take place prior to the key-up of the transmitter power amplifier, a 10 watt TWT. We wanted protection during the preamplifier's switching, and to allow that to be done first. Then, in sequence, we wanted the transmit circuits to be switched into place, preparing the converter for a transmit function. This protects the receive preamp during transmit. (By the way, this same preamp is used as the transmit preamp during transmitting.)

Conversely, when we released our push-to-talk circuit (return to receive from transmit), we wanted the high level switching to de-activate first, turning off the high power amplifier and removing its coaxial from the circuit. Then, after a timing delay, we wanted the low level circuit to return to its normal receive configuration. This prevents the 10 watt TWT power amplifier from coupling any energy into receiver circuits. There is a chance of destroying the low-noise receiver's front end from transmitter coupling with switching errors.

The problem is that we wanted a complex switching circuit with minimum components. Sounds kind of unobtainable, but Kerry N6I2W came up with a very simple circuit to handle it. We used it in both our 10 GHz rigs during the last weekend of the ARRL 10 GHz contest and it worked superbly.

The time delay circuit retained the fast switching of the FET from the original op amp circuit and incorporated a simple RC time constant network with diode steering to accomplish the switching timing needed. A single 4049 hex inverter was used to interface the op amp and FET switching circuit. This portion of the circuit uses diodes for fast turn-on, providing a rapid DC charge of the timing capacitor. There's no RC time constant involved here; it's bypassed by the diode. When the control circuit (PTT) is released, the DC voltage of the op amp reverts towards negative and the charge on the capacitor, shunted by the 1 megohm resistor, forms the first timing circuit, with a delay hang oper-

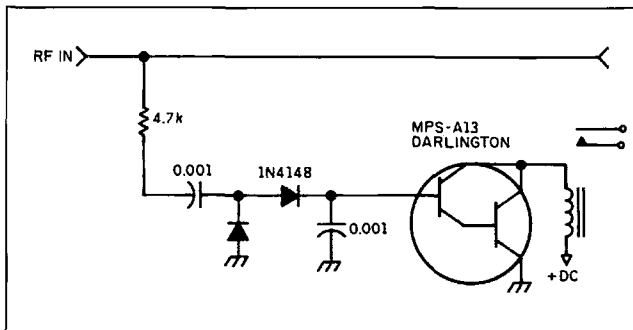


Figure 1. Basic RF switching circuit.

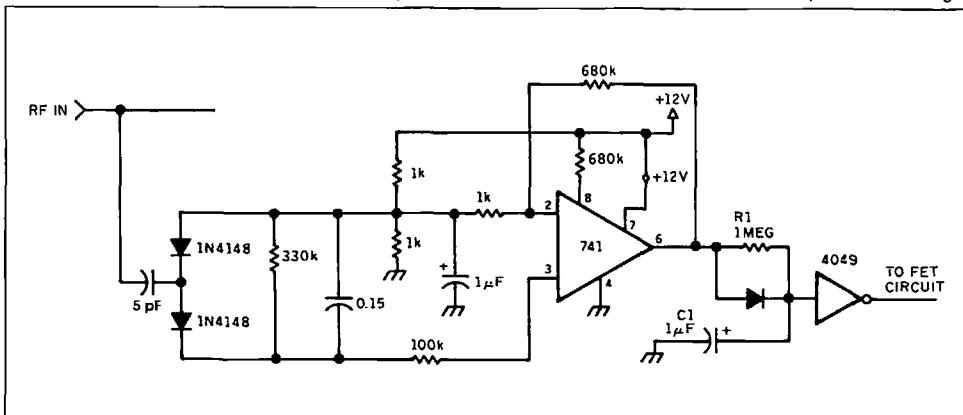


Figure 2. Sensitive RF circuit for SSB.

ation of about a second or so.

In the release cycle (receive), this circuit provides a one-second time constant. The diode is effectively out of the circuit at this time. This release time constant is sufficient to hold the circuit operational between SSB modulations, to prevent premature release of the keying relays. If you want a longer time, increase the capacitor value. Adding an additional 1 μ F capacitor (now 2 μ F total) gives a two-second hold time.

Two FETs were used in our circuit: one for the receive circuits and the other for the transmit circuits. The speed of operation for each circuit is determined by the R/C time constants on the FET's inputs. The hold time or hang time after releasing is controlled by diode steering of the exact opposite timing to the other FET's gate circuit, accomplished by the RC charging time constants of a 1k resistor and 1 μ F capacitor vs. a 47k resistor and 1 μ F capacitor. That controls the key-up time control. For the circuit to meet design constraints, the exact reverse of each circuit is needed. This was accomplished by using diode logic to take the voltage available on the opposite charged capacitor to control the other FET's gate. See Figure 3, the FET switching delay circuit.

The switching relays used for control were connected to ground in each of the two FET source leads. The drains were tied to Vcc (+12 volts). As long as the op amp is off (no RF detected), the relays are in a released condition. The relays used for control voltage are not special relays. A suitable relay for 12 volt operation can be purchased from Radio Shack (PN 275-217; \$5.99 each). Any low current 12 volt multicontact relay can be substituted and should work well. I scrounged my relays off of some junk PC boards and saved a few bucks.

How do you unsolder multicontact items from PC boards? Well, get down to your local hardware store and purchase a paint-stripping heat gun. It unsolders better than it strips old paint, and it's inexpensive, less than \$20.

Putting the circuit to use is the custom part of the exercise. I will describe my application, but your circuit will vary, depending on how you switch your rig's elements about. In my transceiver, I switch my preamplifier forward and in reverse, using it for receive and transmit. Additionally, in transmit I switch the now reversed preamp to drive the TWT amplifier to full power output. To accomplish this switching I use a bank of four SPDT coaxial relays. Another relay is used to switch out a direct connection from the mixer IF port to the HT and replace it with a 10 dB attenuator for transmitting. The third switch point is internal to the TWT power supply to transfer it from standby to transmit.

My sequence of events is as follows: I want the four relays to actuate first, along with the IF switching relay. Then and only then do I want the TWT relay to actuate. In this way I

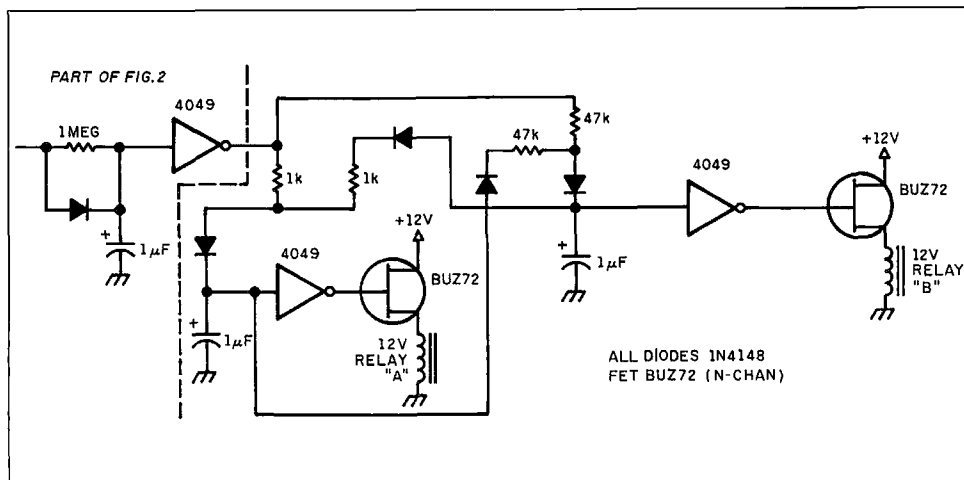


Figure 3. Timed FET switching circuit.

protect the low-noise preamplifier from the transmitter power stages by keying the power amplifier last when going to transmit. In the power down sequence this same relay must release first. This switching sequence will be similar in your situation, depending on what constitutes your elements. In any case, to set up your system's switching requirements, all you need to know is which relay is fast to operate and slow to release. See Figure 4 for the full system schematic diagram.

In actual practice, both our rigs have the circuit constructed dead bug fashion on a scrap piece of copper PC board. The FETs I used were BUZ-72 types, capable of several amps of switching capacity for relay drivers. Quite an overkill, but they should work for quite a while without problems.

I plan to make artwork for this PC board in the future and will put it in the column in another issue.

West Coast VHF/UHF Conference

The West Coast VHF/UHF confer-

ence will be held in Ventura, California, on the weekend of May 12 through 14th, at the Ventura Holiday Inn, 450 East Harbor Boulevard. Planned events include technical talks and vendor exhibits, and a Saturday banquet and Sunday breakfast, both with guest speakers. On Sunday, antenna range capabilities with pattern plots will be calculated. A color plotter will make plots, labeling each with antenna description and 3 dB beamwidth. Coverage will include 2 meters through 10 GHz. The test range, 300 feet long, will be located on top of the parking garage next to the hotel.

The noise figure measurements, a very popular test session, will also have plotting of your VHF and UHF converters and preamps. This is a tradition deep-rooted in the many conferences that have been held over the years. Hewlett Packard will provide the latest noise figure meter, which will be integrated with a computer and a graphics printer. For anyone who intends to bring preamps, standard con-

nectors are a necessity. They should be female SMA, N, BNC or UHF to allow measurements to be made. Please provide clearly marked power terminals that can be test-clipped for the test measurement. I would add, mark the power pins clearly, least you have a 90 dB attenuator.

Registration for the conference is \$15, due by May 7, for pre-registration awards. For information, contact the Ventura County Amateur Radio Club, VCARC PO Box 2103, Oxnard CA 93033, or Steve Noll WA6EJO at (805) 647-4294. For exhibit space, call (805) 264-1978.

As is normal practice, the ARRL will publish the proceedings for the VHF/UHF conference and will make them available at the conference for \$10. After the conference they will be available from the ARRL directly for \$10 plus appropriate shipping.

Well, that's it for this month. As always, I will be glad to answer any questions related to VHF and UHF. For a prompt response please send an SASE. 73 Chuck WB6IGP.

73

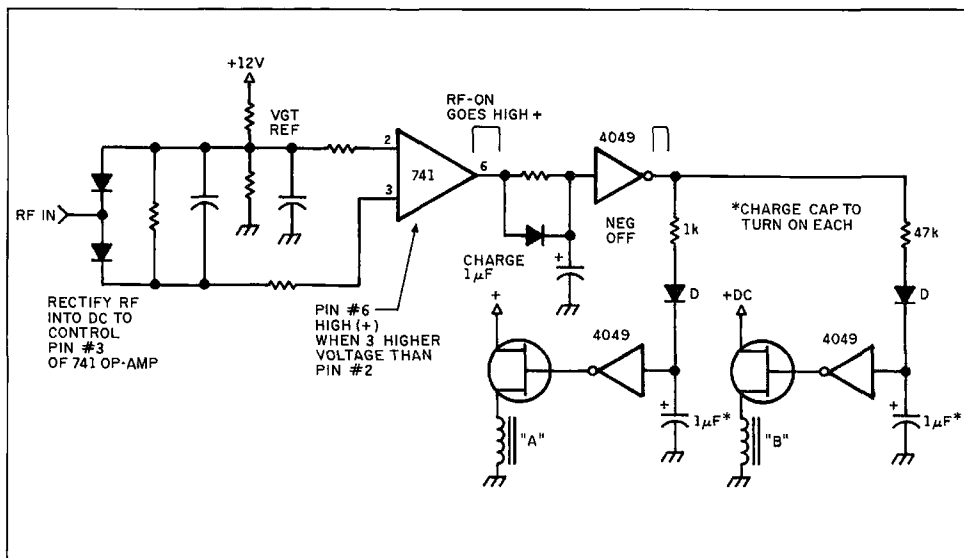


Figure 4. Full switching schematic diagram.

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Fixing Walkies

Probably the most common piece of ham equipment today is the 2-meter HT. Especially since the advent of the no-code Technician license, the popularity of walkies has increased. I haven't met very many hams who don't own walkies. So, it seems reasonable that some of those radios are going to have problems. Let's look at the kinds of problems which tend to occur and at what we can do about them.

What a Cad

Nickel-cad, that is. If you've owned your walkie for more than a year or two, chances are you either have had or soon will have trouble with the battery pack. No matter what the industry says, those darned NiCd batteries just don't last very long. By now, everybody knows that you should run the battery all the way down before you charge it up again. But, even if you do that, a year or two is about all you can ask for. I have met hams who had properly working packs more than three years old, but not very many. My own experience has been pretty dismal, despite the fact that I follow all the rules. Is it possible to actually fix a bad battery pack?

Well, sometimes. In fact, I just fixed one in my cordless drill a few weeks ago, and it's still going strong. I've described before how to zap a NiCd cell, but I'll give a brief repeat here for those who missed it.

There are two fixes which have worked for me. For shorted cells, take a DC power supply and charge up an electrolytic capacitor. The cap should be several thousand microfarads or more; a 100-microfarad cap just won't do it. Charge it to 15 volts or so, being careful to ensure that the cap is rated for more than that. Don't forget to watch the polarity. Now, again watching the polarity, connect it across the shorted cell, + to + and - to -. Don't use clip leads, because their resistance can limit the current flow. Just touch the cap's leads to those of the cell. You should get a nice little spark. Disconnect the cap and measure the cell's voltage. If you get anything much above zero, you've done it; the cell should now charge properly. If the cell is still shorted, try again. It took me 10 tries to fix that drill's cell.

For cells which aren't shorted but just won't hold a charge, I've found that a few seconds of high-current charging can sometimes do wonders. By high current, I'm talking about a couple of amps, not 20! A current-limited DC supply works fine. This fix isn't as dramatic as the other one, but it might save your ailing pack.

Neither of these fixes can be done without getting access to the terminals of the bad cell; you can't do this stuff *through* the other cells in a pack.

After you've fixed a bad cell, you must balance all the other cells before you try to recharge the pack. If you don't, the bad cell most likely will fail again very soon. To balance the pack, charge the bad cell to, say, 1 volt. Then, *discharge* all the other ones through a flashlight bulb, one cell at a time, until they all read 1 volt. Reassemble the pack and charge it normally, and it should work fine if the cells are not too far gone.

By the way, most NiCd packs have built-in thermal fuses that are designed to prevent fires in packs which inadvertently get shorted at their terminals, perhaps by keys or coins in a pocket. If the pack has in fact died immediately after experiencing such a short, a new thermal fuse may be all you need. I don't know where you can buy new ones, but perhaps one of you does. If so, please tell me and I'll pass it along. But please don't even consider simply shorting across the fuse and putting the pack back in service. Even small NiCd packs can deliver enough current into a short to cause serious injury. That's why manufacturers always warn you not to put NiCd cells into holders meant for alkalines; the holders have no fuses, because alkalines don't present nearly as much risk.

Insert Here

Sometimes, NiCd cells simply are beyond redemption. And new packs from the manufacturers are awfully expensive. Besides, my experience has been that most manufacturers

use exceptionally poor cells. When a battery pack goes bad six months after you buy the rig, you sure don't want to shell out for another one just like it! Luckily, several aftermarket companies advertise inserts for walkie packs. These are pre-connected cells which fit into your original plastic shell. I tried one in the FNB-17 pack for my Yaesu FT-411 and it worked great! If you can crack the original pack open carefully enough that it can be snapped or glued back together, you would do well to try an insert. Often, soldering is required but, hey, we're hams, right? By the way, the one brand of cells I've had good results with has been Sanyo. I've seen, and in fact own, Sanyo cells that are five years old and have been abused, yet still work fine. I have no idea why theirs are so much better, but I strongly recommend you buy an insert made with them. You'll wind up with a better pack, at about 1/2 to 1/3 the price of a new, original-equipment pack.

Where's the Magnifying Glass?

OK, your walkie is getting power but it still doesn't work right. Walkies are basically no different than other radios, but they do have some unique characteristics which make them a bit harder to work on. The most obvious one is that they are getting awfully *small* these days. Back when the ICOM IC-2AT and Yaesu FT-208R were all the rage, you still could fit your fingers into the case. Nowadays, things have gotten to the point where surface-mounted components and ribbon cables dominate. How do you fix something like that?

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Frankly, if the problem is really tough from a physical standpoint, it probably isn't worth the risk to the radio for you to hack at it. For instance, some modern walkies, such as my FT-411, use little "daughterboards" which stand up on a motherboard. Unlike the similar construction used in desktop computers, though, these daughterboards are maybe an inch square, and they're soldered in. If a tiny chip or transistor goes bad on one of them, just getting to it in order to measure the voltage or observe the signal can be a major chore. Even worse, some circuits may be spread out between what's on the daughterboard and some parts on the back side of the motherboard. Do you really want to mess with this?

Well, maybe, maybe not. If the problem is not obvious, it probably would pay to send it in for repair. Luckily, though, most problems are not due to component failure. Because walkies are so portable, they experience far more troubles caused by bad connections, broken or dirty jacks and switches, corrosion and similar environmental factors.

Open Wide

Before you can fix it, of course, you have to get inside the rig! Most of today's walkies pop apart in two halves, with just a few screws holding them together. Usually, you have to remove the plate which holds the bat-

tery contacts on the bottom. Then, remove the screws on the back and the rig should snap open. Do it carefully, though, because the two halves probably are joined by a ribbon cable, and you don't want to damage that, believe me. If there is a ribbon cable, it should have a removable connector on at least one side. Generally, these covers snap up and down. If you need to pull the radio apart farther than the cable will allow, locate the connector. Now, gently pry up (up being toward the cable) the cover, one side at a time, using your fingernail. The cable should come out easily. (Before you remove it, take note of which way it goes in; reassembling it backward can result in disaster.) If it still seems hard, don't pull! Instead, be sure you have disengaged the cover as far as it will go. When you reassemble it later, be sure to insert the cable all the way before snapping the cover closed. I've seen many cases of "failures" caused by improper reassembly of ribbon cable connectors. And, especially when the cable is one of those plastic things with the printed-on conductors, it is all too easy to rip it and ruin it. So, let the fixer beware!

Contact!

If your walkie is behaving erratically, and especially if it's cutting in and out, check the battery contacts. Dirty, bent or worn contacts can cause a

bewildering array of symptoms. If the contacts look OK, check the wiring to the DC power jack, if there is one. If the jack is soldered directly to the board, look at the solder joints. Very often, the stress of plugging in and unplugging the DC plug will cause those joints to crack. If you're not sure, resolder them for good measure. Also, check that the PC board foils are not themselves broken. Just wiggle the jack a little while looking at the foils and it should be obvious if there's a problem. Now and then, the DC jack itself can go bad, especially if the radio is old. If you don't plug DC directly into the walkie, though, it is unlikely that you will have any of these problems.

Walkies usually have fuses between the DC input and the rest of the rig. These sometimes look like tiny glass resistors, while other times they look exactly like regular resistors. What they *don't* look like, of course, are fuses! With the power and battery disconnected, a simple ohmmeter check will tell you if there's any connection from one side to the other. I've seen these tiny fuses blow with no provocation. As with the battery packs, it's important that you replace the fuse, rather than just jumping across it.

Well, we've just scratched the surface of walkie repair, so let's continue next time. Now, let's look at a letter:

Dear Kaboom,

I have a KDK model 2033 mobile rig and it won't transmit or receive. I think the problem is in the final. Where can I get one of these transistors? I've enclosed a drawing of it and the ohmmeter readings between its pins and case. I've looked in every catalog I have and can't locate the part.

Signed,
Finally Quit

Dear Finally,

First of all, that is not a transistor! It is a final amplifier *module* which contains the final transistor and a whole lot of other things. The Toshiba S-AV7 is used in various rigs, and you should be able to get one from KDK or another manufacturer. But I don't think you need one! If it were shorted, it should blow the fuse in the radio's DC line when you pressed transmit, and perhaps even in receive, depending on the radio's design. If it were open, it would kill the transmitter's output, but it shouldn't affect receive at all! Because the radio won't TX or RX, I'd look elsewhere. Lots of other things could be causing this general failure, which is lucky for you because those modules ain't cheap. See if you can figure out why the rig won't receive. Chances are that when you fix that, it'll transmit too. Good luck!

73, and see you all next month. 73

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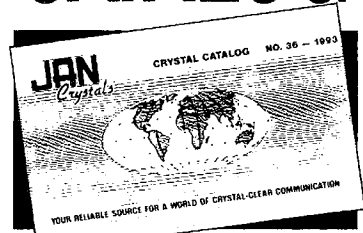


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Commodore Interface

A few months ago, I detailed one ham's odyssey of trying to find a usable interface for an old Commodore computer. I received another response, this one from G. H. Doherty VE3BYR, of Barrie, Ontario.

He tells me that Comtech Research, of Custar, Ohio, has an excellent RTTY program for PC compatibles, which is easy to use and can be configured to work with the CP-1 interface with a minimum of trouble. A serial interface is required to use the interface. If there is not one on the unit already, he passes along this tip for adding one, with a bare minimum of parts: Plug a 75154 chip into a socket wired to a 16-pin header, according to the wiring diagram in Figure 1. The header is then plugged into the original U-13 socket in the CP-1.

He says that the CP-1 has excellent filters, and that he has used it

with a Kenwood TS-830 on RTTY with no problems. On his ICOM 765, the gain to the MIC input is a little low and, according to him, AEA suggests that R116 could be reduced to a lower value, but no lower than 560 ohms. Presumably, this is to increase output.

The RTTY-PC Program

The RTTY program referred to is RTTY-PC, Version 1.07, from Comtech Research. According to the literature I have here, it will send or receive Baudot at 60, 66, 75, and 100 wpm; or ASCII at most standard speeds from 110 baud to 9600 baud. The initial display is of received data. A control menu is entered from that screen.

The display itself is a split-screen affair, with transmit and receive data displayed separately. Mode, speed, date, time, and other data are displayed as well. Twelve 1K buffers are available, accessed through the F1 through F12 keys. Even if your computer does not support all 12 function keys, they say that they

have software that will allow you to use all 12 buffers.

The computer can initiate transmit/receive switching, store received material to disk, and do just about anything else you might think is important for a RTTY program to do. All in all, this sounds like a full-functioned program.

Price? According to this sheet, \$29.95 for the program, \$8 for a printed copy of the manual which is on the disk, and \$5 extra if you want the program on a 3.5", 1.44 Mb disk. Shipping and handling adds another \$3 for North American deliveries, \$5.25 elsewhere.

If you're interested, drop them a line at 5220 Milton Road, Custar OH 43511, and ask for the latest pricing and availability. As always, feel free to drop the name "RTTY Loop" in your letter.

Another Model 28

Web Williams KD4CQK, of Myrtle Beach, South Carolina, says that Ralph Brown is not the only one trying to get a Model 28 up and running—he has one also. He says that his machine has a keyboard, reper, printer, and tape reader. To clarify terminology, that would be a Model 28 ASR, standing for Automatic Send Receive. The "KSR" machine is Keyboard Send Receive, and lacks the tape equipment.

Hopefully, the material published last month was of some use to Web. He adds that it appears as though old terminal units have disappeared from the market. He has been trying, without success, to find one. With a PC compatible and MFJ-1278 in the shack, he can operate on RTTY, so it's not the mode he lacks, it's the method!

If someone in his area has a TU to spare (Web is especially looking for a Dovetronics, or HAL ST-6000 or ST-5000), I am sure he would appreciate hearing from you. Information may be sent here as well, and I will forward it down Carolina way. Thanks for the letter, Web.

CompuServe in Hong Kong

I appreciated the message on CompuServe from Ron Koyich VS6BD, whose interest in RTTY dates back to the 1960s, when he even went mobile with a Model 15. Now THAT's something my wife never let me do! In those days, Ron went under the call of VE6AJX. Hmmm, another AJ! That gets you an honorary membership in the club.

He adds that a CompuServe node is now active in Hong Kong. It will be awhile before they will be able to packet/AMTOR to us from there. There's a Hong Kong packet

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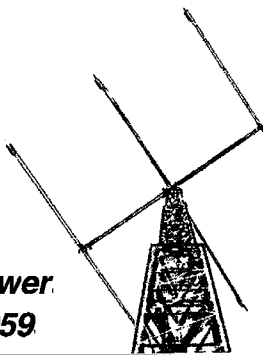
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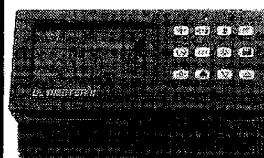


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repeater going online sometime this year, to be installed and operated by ELARCS (English Language Amateur Radio Communications Society).

Sounds great, Ron. Keep us posted of the progress. I am sure that those of us in more mundane locales can only dream of some of the stuff you must see over there. Thanks for the note.

DSP-12 for Contesting

Another piece of Email was received from Doug Stracener KA5YSY, in Baton Rouge, Louisiana. Doug relates his experiences in the RTTY DX Worldwide contest, in which he used the DSP-12 processor.

Doug writes, "On Friday evening at 0000Z, the start of the contest, I had fired up my trusty Kenwood TS830 on 15 meters and started contesting with great vigor. Enter Mr. Murphy: At 0010Z the 830 went on strike and refused to transmit on 15 meters! This is not good when one is working single band, single op! The real problem was that the 830 has a set of International Radio crystal filters that are extremely selective on RTTY and make contesting possible.

"Enter the ICOM 735, which is my mobile radio. It has no special filtering other than the standard SSB.

The selectivity for RTTY contests is at best poor, so I was wondering what kind of score would be possible, due to all the QRM and my inability to resolve the signals.

"I recently purchased one of the NIR-10 DSP filters built by JPS Communications of Raleigh, North Carolina, for the purpose of killing the white noise present on the OSCAR-13 audio when I am working satellites. In desperation, I quickly cabled the audio input of the DSP-12 to the ICOM and placed the filter in the passband medium and then narrow modes. Oh, what a difference the DSP-12 made! It is superior in all respects to the crystal filtering of the Kenwood setup and allowed me to operate in high ORM environments of the contest without any difficulty. When turning off the DSP-12 by placing it in the bypass mode, the KAM

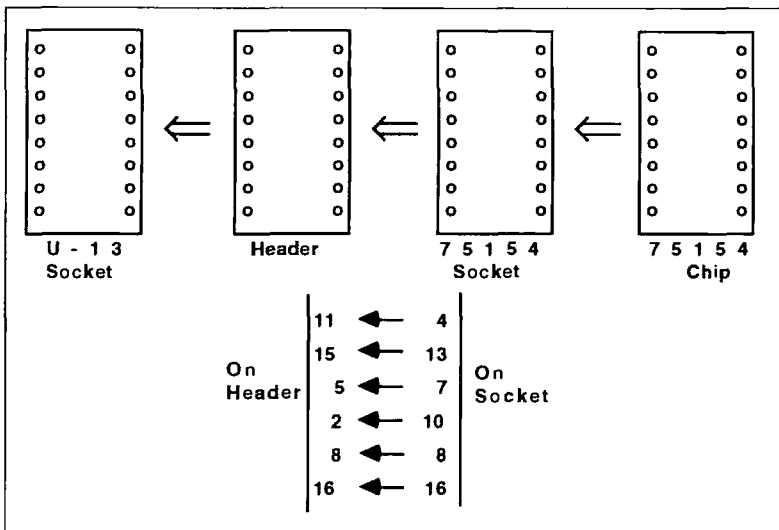


Figure 1. Interface wiring for the CP-1.

TNC I was using was unable to decode any of the multiple RTTY signals within the receiver audio passband.

"Based on the experience I had, I can highly recommend the DSP-12 to any RTTY contest as a piece of equipment well worth the price. On the other hand, maybe you should not tell anyone about this,

and let me keep the secret!"

You don't have to be in Hong Kong to drop me a note. Reach me on CompuServe at ppn 75036.2501; Delphi at username MarcWA3AJR; or America Online at screen name MarcWA3AJR.

Sure, you can write me at the above address as well. Just write, I really do want to hear from you.

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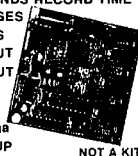
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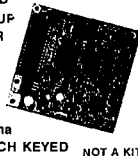


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Computer Control For The Ramsey FTR-146

Build a computer interface for this 2 meter transceiver kit.

by Richard E. Lucka WD8BNR

For a long time I have wanted to use my IBM-compatible personal computer (PC) to control the frequencies of a 2 meter transceiver. I have two Kenwood rigs, but I just don't have the heart to tear these expensive rigs apart to connect them to the computer.

About a year ago, I saw an ad from Ramsey Electronics featuring their FTR-146 2 meter synthesized transceiver. What caught my eye was that the frequencies could be programmed by diodes. I immediately saw the possibility of building an interface to control the rig with my computer, so I ordered a kit.

After building the radio and studying the schematic, I came up with a programmable interface that allows me to program the frequencies using the parallel printer port from my PC. Additionally, I can select the repeater offsets (simplex, +600 and -600) and the +5 kHz channel spacing. I can also "see" the programmed binary inputs to the rig by looking at the LEDs mounted on the interface front panel. Finally, I added a new feature to the rig by tapping into the squelch output pin of the rig's FM detector chip that lets my computer detect the presence of a signal. I added an LED that lights when the rig is receiving a signal.

In this article, I will describe the interface circuit, the cable connections, and a BASIC program that selects frequencies and performs scanning operations on the Ramsey kit.

The Interface

The heart of the rig's tuning capability is the MC145106 digital frequency synthesizer chip. The kit's manual contains an excellent description of how it works and how you can program selected frequencies using a diode matrix. The manual also hints at how you can use DIP switches for selecting your own synthesizer inputs. Beyond that, it's up to you to create another way of programming the frequencies.

The 5106 synthesizer contains nine input pins. Each input may be "on" (+8 volts) or "off" (0 volts). The combination of "on" and "off" inputs determines the frequency you want. The inputs coincide with digital numbers, starting with 1 and ending with 256. In other words, the pins are labeled 1, 2, 4, 8, 16, 32, 64, 128, and 256. If you add up all

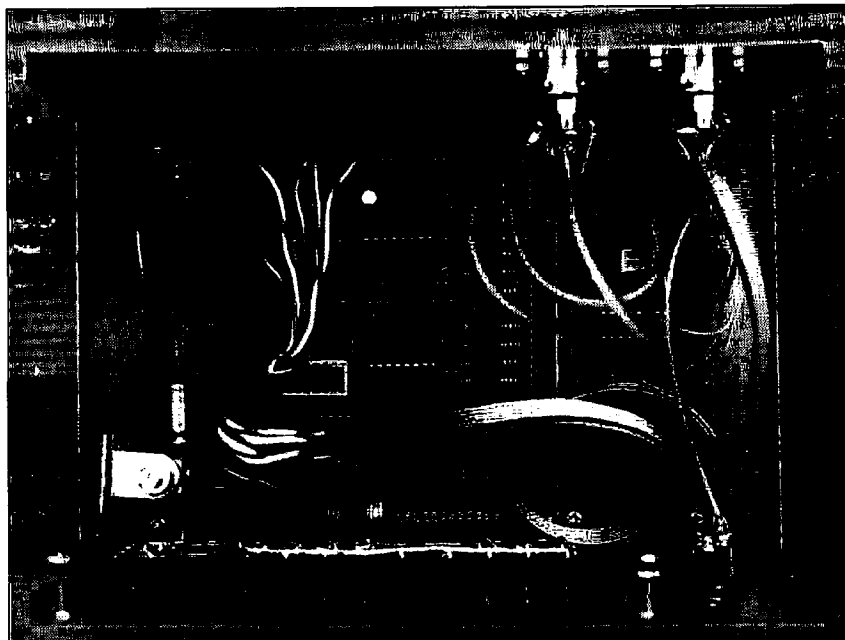


Photo A. Parts placement of the interface on a Radio Shack 276-147 board inside an RS 270-274 cabinet. The LEDs are installed on another RS 276-147 (cut in half) and mounted inside the front panel. The circuit on the right side of the board is a packet modem interface, described in "Poor Man's Packet," 73 Amateur Radio Today, August 1991.

the numbers, you get 511 frequency possibilities.

There are a total of 400 channels in the 2 meter band, all spaced 10 kHz apart. The synthesizer can tune an additional 111 channels ($511 - 400 = 111$). If all the input pins are low, the synthesizer generates the lowest frequency, which is 143.00 MHz. If all the input pins are high (+8 volts), the synthesizer generates the highest frequency, which is 148.11 MHz. Consequently, the combination of the inputs produces frequencies within the 143.00 and 148.11 MHz range.

Figure 1 shows the schematic of the interface. The circuit uses all eight data output lines from the PC parallel port to program two 74LS373 D-type latches (U3 and U4) through two 4050 hex non-inverting buffers (U1 and U2).

The latches are the focal point of the interface. You program the latches to feed programming data into the transceiver. When the enable input (pin 11 of U3 or U4) is low,

data is loaded from the input pins. When the enable input is high, the data is "held" at the output. The latch is a perfect device for holding programming data and driving devices such as the synthesizer.

The STROBE output line from the printer port selects latch U3 and the INIT line selects latch U4. Only one 74LS373 latch can be programmed at a time. This arrangement allows you to latch 16 bits rather than eight bits. Remember, there are nine inputs to the synthesizer, and additional inputs for the simplex, +600 and -600 repeater offsets, plus the +5 kHz channel spacing input. That comes to a total of 13 inputs with three spares. I am using the spares to drive three LEDs for displaying status information for packet radio purposes.

There is an LED connected to each of the latch outputs. They let you see how your PC is programming your rig. You'll find them to be tremendous debugging aids if you want to write your own software for your rig.

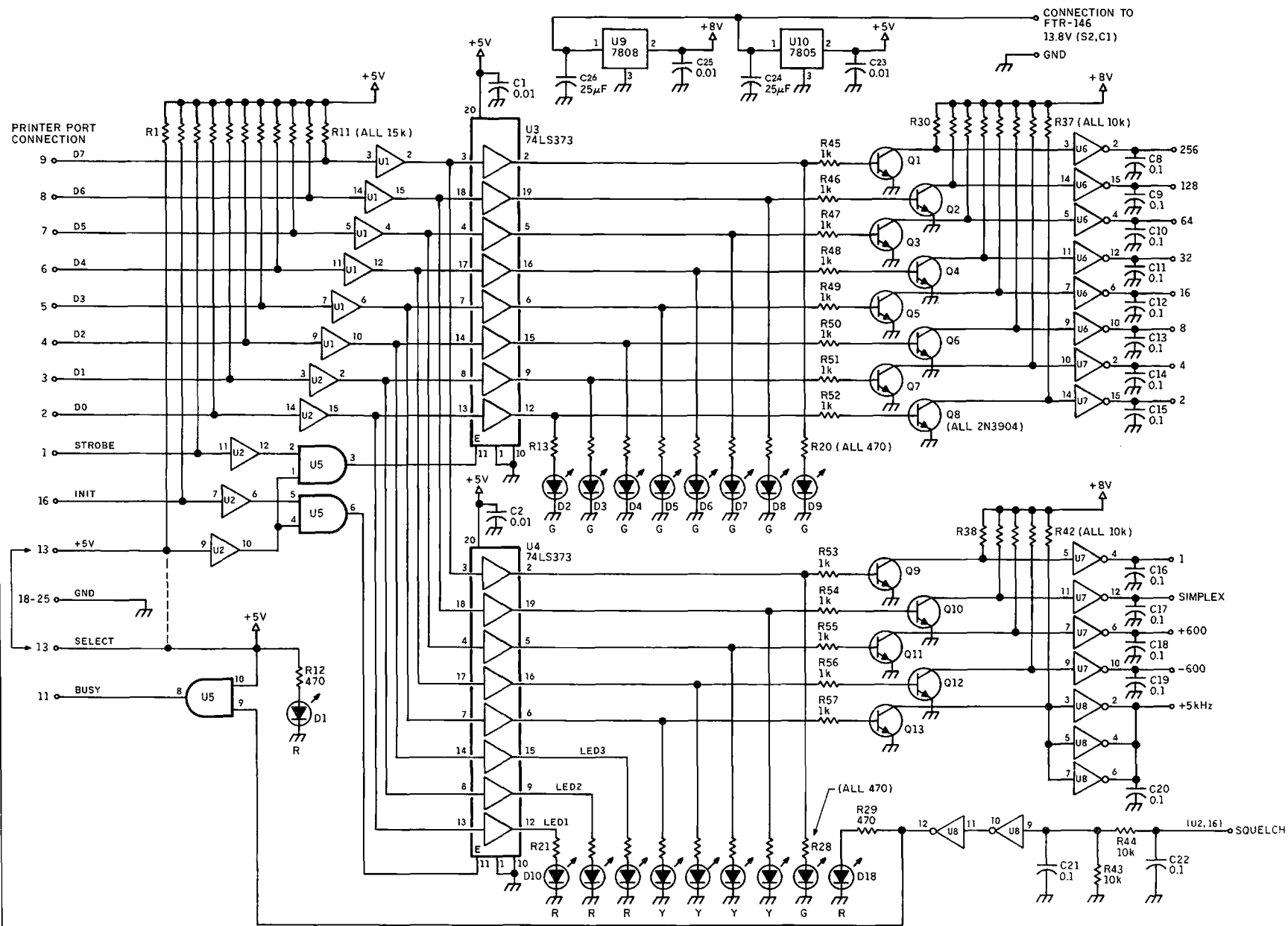


Figure 1. Schematic diagram of the FTR-146 transceiver-to-PC interface.

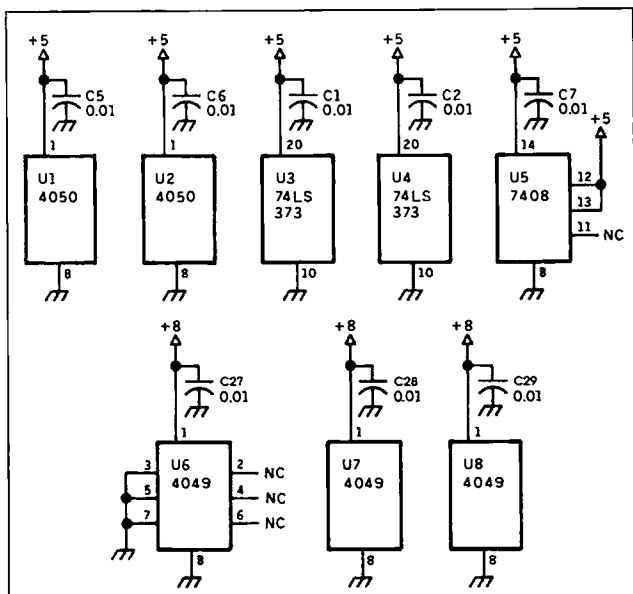


Figure 2. Power supply, voltage shunting capacitors and ordered gate connections for U1 through U8.

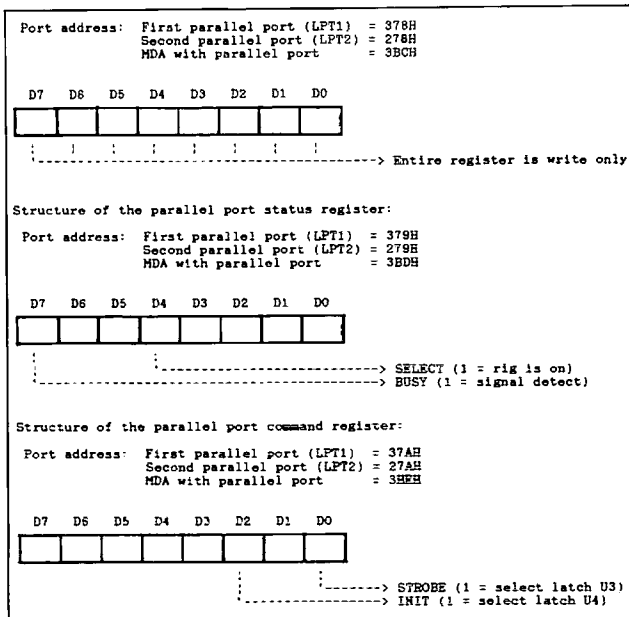


Figure 3. PC parallel port layout.

Thus far, we have dealt with TTL voltage levels (up to 5 volts) for the latches and the non-inverting buffers. The voltages coming out of the PC's parallel printer port pins are at TTL levels and are enough to drive the input buffers U1 and U2. Additionally, the voltages coming out of the latches, being slightly loaded down by the LEDs, are just high enough to drive other TTL devices, but may not be high enough to drive the synthesizer in the rig and definitely not enough to drive the repeater offsets and +5 kHz channel spacing.

I solved this problem by adding a voltage amplifier and a hex inverting buffer for each of the latch outputs (Q1-Q13, U6 through U8). If a latch output is low, it turns off a transistor, which causes the collector voltage to rise to the 8-volt supply voltage. This makes the associated hex inverter turn off (low) at the output, and therefore turns off an input to the synthesizer chip in the rig.

If a latch output is high, it saturates the transistor, causing current to flow. This drops the collector voltage below the operating threshold of the inverting buffer input, which causes its output to go high. This turns on an input to the synthesizer.

The above scenario is also the same for the repeater offsets and the +5 kHz channel spacing. However, I used three inverter gates (U8) to drive the +5 kHz channel spacing circuit. One gate is insufficient to source a full 8 volts for this input, due to the rig's circuit loading.

When you program the repeater offsets, you enable an oscillator circuit by applying a voltage (high) at the appropriate latch output. You are only supposed to select one. Be very careful as it is easy to enable or program two or three oscillators at the same time. You can control this by software and verify by observing the LEDs.

As mentioned in the introduction, another

feature of the interface is the signal detect input to the BUSY line of the printer port. The 3359 FM detector (U2, pin 16) in the transceiver has a squelch output pin that connects to a cutoff transistor (Q14 in the rig) for the audio amplifier. If there is a signal in the receiver portion, a voltage at the base of Q14 enables the audio amplifier, thus disabling the squelch. I connected pin 16 of U2 (in the rig) to the BUSY input line via the remaining inverting buffer gates (U8, pin 9 in Figure 1) to reduce the voltage to TTL levels. The buffer also lights an LED (D18) to indicate a signal is being received.

The SELECT input in your printer port is tied to the +5 volt supply. This merely serves as a signal to your computer indicating whether your rig is turned on, making your computer a little smarter.

The SELECT input is also tied to pin 9 of U2. I made this connection at the printer port connector. However, you may elect to wire the SELECT or +5 volts directly to pin 9 of U2 (dotted line on schematic and PC board). This voltage enables the other half of AND gates U5 for programming the latches.

Figure 1 shows the Vcc (power supply voltage) connection to U3 and U4 shunted with 0.01 µF capacitors. Figure 2 shows the Vcc connection to all the IC chips in the interface. Note carefully that U1 through U5 are connected to the +5-volt supply and U6 through U8 are connected to the +8-volt supply.

Figure 2 also shows the unused gates of U5 and U6. The unused inputs to U5 should be tied to +5 volts to minimize current and to prevent oscillation, while the unused inputs to U6 should be tied to ground to minimize current.

Construction

I planned to construct the circuit so that it would fit in a Radio Shack 270-274 metal

cabinet. I constructed the circuit on a Radio Shack 276-147 pre-drilled board and used 24-gauge bell wire for the point-to-point wiring. I used sockets for the chips so I could measure voltages later, before installing the chips.

[Ed. Note: A PC board is available for this project from FAR Circuits (see the Parts List for order information); also see Figure 4 for the foil pattern and parts placement.]

There was more than enough space on the board to mount all the parts of the circuit, except for the LEDs (I wanted them to be on the front panel). How you want to lay them out is pretty much up to you because parts placement is not critical. I carefully laid out the chip sockets on the board, making sure that there would be room for all the resistors and capacitors and point-to-point wiring (see Photo A). I soldered the sockets only at the opposite pins, just enough to keep them in place. This allowed me to insert the wires and leads directly into the socket pins and lightly solder them in place.

I carefully laid out how I wanted to line up the LEDs, with the programming LEDs on the top row and the offset and status LEDs on the bottom row (see Photo B). Since I like multiple colors, I used green LEDs for the top row and yellow and red for the bottom row. After drawing the LED layout and using it as a template, I drilled the holes and installed the LED caps. I also drilled the holes for the mounting hardware.

I cut another 276-147 pre-drilled board in half for use as an LED board. The half-size fits nicely inside the front panel. I loosely installed the LEDs on the LED board and mounted the board on the front panel. I used spacers for the 4-40 hardware to keep the board about 3/4" away from the inside cabinet surface. Then, I manipulated the LEDs (loosely hanging between the board and the

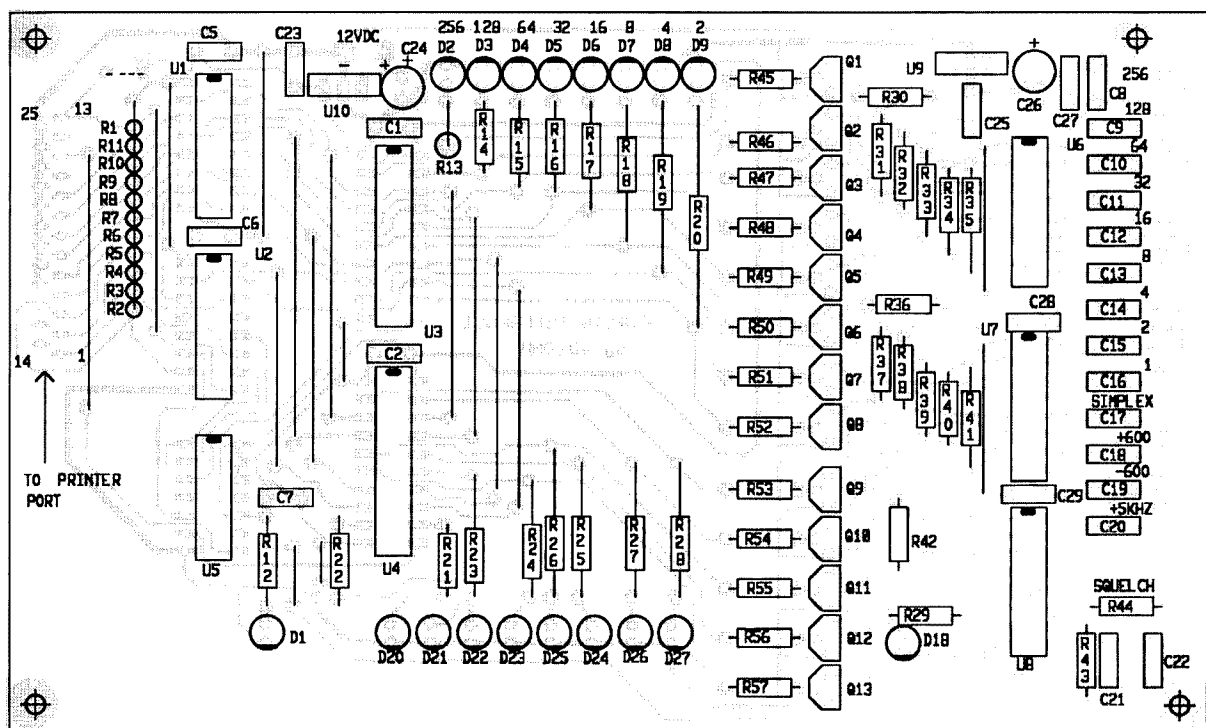
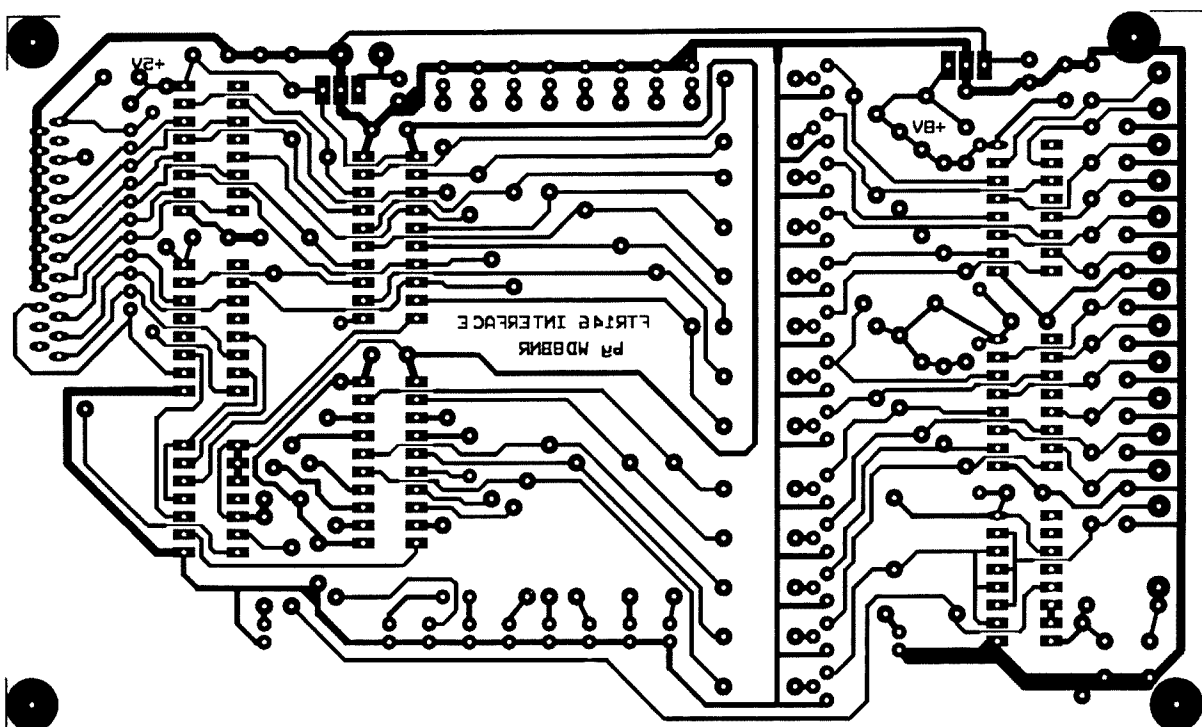


Figure 4.

inside cabinet surface) by grasping the LED leads and inserted the bulb parts into their respective caps. After making sure that the LEDs were firmly seated in the caps, I soldered the leads in place. This made it easier

to remove the board, install the resistors, and re-install the board. I used ribbon cables to connect the LED board to the main board.

I used a 25-wire flat ribbon cable to make the actual connections from the transceiver

to the interface cable (see Photo C). As a result, I was able to use the metal case and knob set for the rig from Ramsey because the ribbon cable fit snugly between the top and the rear panel. At the end of the ribbon

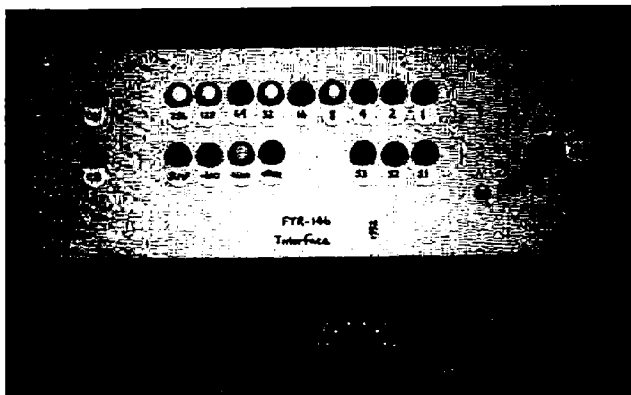


Photo B. The front panel of the FTR-146 interface. The PKT LED is connected to a modem interface circuit and is unrelated to this article. The switch on the right side of the panel is set at "AUTO," which allows latch (U4) to program the +5 kHz channel spacing. The other choices manually set the channel spacing to "off" or "on."



Photo C. Flat ribbon cable runs from the rear of the transceiver to the 25-pin male D-SUB cable.

cable is a male 25-pin D-SUB connector. I happened to have a length of 25-wire cable, so I attached a female D-SUB connector at one end and attached the other end to the interface.

Ramsey had the experimenter in mind when they drilled an extra set of holes in the circuit board for programming the frequency synthesizer. There are six sets of holes for building a diode matrix for six frequencies, and each are enabled by one of six positions

of the 12-position rotary switch S1 (the other six positions are not used). The seventh (and extra) set of holes is where I connected the ribbon cables. These holes have inputs for the nine input pins of the synthesizer (256 through 1), the transmit repeater offsets (simplex, +600 and -600), and the +5 kHz channel spacing. The right side of Figure 1 shows all the connections to the rig via the ribbon cable.

I attached a length of 25-wire cable to the computer side of the interface and attached a male D-SUB connector for the PC parallel

printer port. See the left side of Figure 1 for the wiring diagram. In reality, you can use a 15-wire cable instead.

To supply power to the interface, I connected the 13.8-volt power supply voltage from the off/on switch in the rig to the voltage regulators U9 and U10. Thus, the interface comes on only when the rig is on.

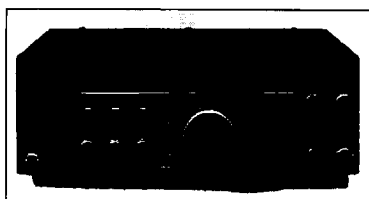
Check-Out

After thoroughly checking my wiring, I temporarily connected the interface to a 13.8-volt power supply through a 1-amp fuse. Fortunately for me, there was no

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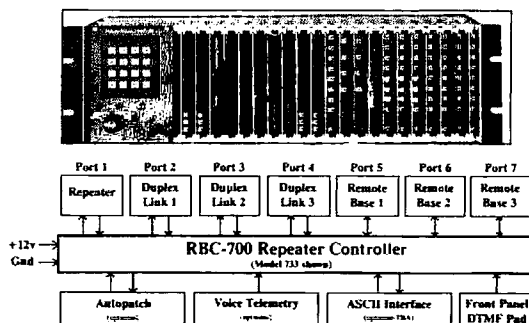
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CIRCLE 264 ON READER SERVICE CARD


```

42000 Send programming word (2 bytes) to radio interface via printer
42010 parallel port.
42020 Entry: WORDS = 16-bit programming data
42030 PORT = base port address of parallel port
42040 FIRST=ASC(LEFTS(WORDS,1)); FIRST = first 8-bit word
42050 CMND=0: CMND = command to set U3 in receive
42060 OUT PORT,FIRST: Write FIRST to data register
42070 OUT PORT+2,CMND: Command U3 to receive data
42080 OUT PORT+2,1: Command U3 to latch data
42090 SECOND=ASC(RIGHTS(WORDS,1)); SECOND = second 8-bit word
42100 CMND=5: CMND = command to set U4 in receive
42110 OUT PORT,SECOND: Write SECOND to data register

```

Listing 1.

smoke or short. After performing voltage checks, I installed the chips. I connected the interface to the computer parallel port and wrote a few BASIC programs to test it. I didn't have to test with the radio connected because I observed the results on the LEDs. After verifying proper operation, I ran the same tests while measuring the radio connections to make sure that the voltage outputs (from 6 to 8 volts) corresponded to the LED readouts.

Software

The printer parallel port contains three registers: the data register, the status register, and the command register (see Figure 3). The data and command registers are output registers and the status register is input. The base port address is hexadecimal 378 for LPT1, 278 for LPT2, or 3BC if you have a Monochrome Display Adapter. If you only

your port is configured as LPT1 (base port = hex 378).

The starting building block of any software you write is a GW-BASIC code fragment, shown in Listing 1. I chose the BASIC language for the sake of this article because everyone who owns an MS-DOS machine already has a BASIC interpreter.

Input to the code in Listing 1 is a 16-bit (2-byte) string (WORDS) containing the frequency inputs (9 bits), the repeater offsets (3 bits—only one can be 1!), the +5 kHz channel spacing (1 bit), and the three status LEDs (3 bits). This string corresponds to the outputs of the latches U3 and U4, consecutively.

To create the WORD\$ string, use lines 40000 through 40470 from Listing 3. This code fragment converts FREQ\$ (frequency and mode in ASCII) to WORD\$. The frequency is the actual frequency you want, such as 146.52 or 146.835. Mode must fol-

```

10 REM INIT146 - Initialize FTR-146 Start Frequency
20 PORT=&H378: Base printer port address
30 FREQS="146.43.S": Start with your favorite frequency
40 GOSUB 42000: Convert FREQS to WORDS
50 GOSUB 40000: Program the radio!
60 SYSTEM: Exit
Put 40000 and 42000 subroutines here from Listing 3

```

Listing 2.

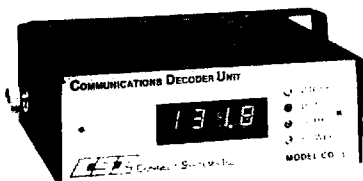
low the frequency after a comma and is a one-character transmit repeater offset character, which can be "S" (simplex), "+" (+600), or "-" (-600). If you don't specify a mode with no comma after the frequency, then simplex is assumed.

You can use this code to verify the integrity of the frequency/mode string FREQ\$. The program in Listing 3, which we will discuss later, asks for a frequency and uses the code fragment to verify and convert the input to WORD\$ and return a numeric status code, STAT%. IF STAT%=0, then FREQ\$ passed the verification edit and the code successfully converted FREQ\$ to WORD\$. If STAT%=1, then FREQ\$ contains a syntax error (no period in the frequency and invalid mode to name a couple of possible problems). If STAT%=2, then the frequency is outside the boundaries of the FTR146 transceiver.

The following two paragraphs describes the function of Listing 1 in detail: Line 42040 transfers the first 8 bits of

Line 42040 transfers the first 8 bits of

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```

10 REM FTRSCAN - FTR-146 Control Program.
20 REM Version for IBM PC clones.
30 REM Author: Richard E. Lucka, WD8BNR.
40 PORT=&H378: 'Centronics base parallel port
50 DELAY=500: 'Delay count during scan.
60 COLOR 2:CLS:PRINT "FTRSCAN Version 1.0 * DATES: PRINT
70 PRINT "Author: Richard E. Lucka, WD8BNR"
80 GOSUB 1120: 'Get frequency list
90 REM Define function key trapping.
100 KEY(1) ON: ON KEY(1) GOSUB 600: 'Decrement frequency by 10 kHz
110 KEY(2) ON: ON KEY(2) GOSUB 700: 'Increment frequency by 10 kHz
120 KEY(3) ON: ON KEY(3) GOSUB 720: 'Decrement frequency by 5 kHz
130 KEY(4) ON: ON KEY(4) GOSUB 740: 'Increment frequency by 5 kHz
140 KEY(5) ON: ON KEY(5) GOSUB 760: 'Enter frequency and mode
150 KEY(6) ON: ON KEY(6) GOSUB 770: 'Set transmit offset to -600 kHz
160 KEY(7) ON: ON KEY(7) GOSUB 780: 'Set transmit offset to Simplex
170 KEY(8) ON: ON KEY(8) GOSUB 790: 'Set transmit offset to +600 kHz
180 KEY(9) ON: ON KEY(9) GOSUB 810: 'Scan frequency down by 10 kHz
190 KEY(10) ON: ON KEY(10) GOSUB 950: 'Scan frequency up by 10 kHz
200 KEY(11) ON: ON KEY(11) GOSUB 1460: 'Down - select previous freq.
210 KEY(14) ON: ON KEY(14) GOSUB 1510: 'Up - select next freq.
220 REM Start by getting a starting frequency.
230 IF FKEY=0 THEN 270
240 FOR I=1 TO 5
250 LOCATE 9+I,14: PRINT SPACES(18);
260 NEXT I
270 LOCATE 5,1
280 LINE INPUT "Enter frequency and mode (f,m) (CR=exit): ";FREQS
290 IF FREQS="" THEN CLS:SYSTEM
300 GOSUB 40000: 'Convert frequency to latch programming word
310 IF STAT%=1 THEN PRINT "Syntax error!": GOTO 410
320 IF STAT%=2 THEN PRINT "Frequency error!": GOTO 410
330 LOCATE 5,1: PRINT SPACES(56): PRINT SPACES(18): TGL=0
335 REM Draw box.
340 LOCATE 10,14: PRINT CHR$(201) CHR$(205) CHR$(205);
350 PRINT "Frequency " CHR$(205) CHR$(205) CHR$(187);
360 FOR I=1 TO 3
370 LOCATE 10+I,14: PRINT CHR$(186):: LOCATE 10+I,30: PRINT CHR$(186);
380 NEXT I
390 LOCATE 14,14: PRINT CHR$(200) STRINGS(15,CHR$(205)) CHR$(188);
400 GOTO 430
410 LOCATE 5,43: PRINT " ": LOCATE 5,1: GOTO 280
420 REM Program the freq and show on screen.
430 GOSUB 42000: GOSUB 1080
440 A=INSTR(FREQS,"")
450 IF A=0 THEN HLDLFREQ=VAL(FREQS)<1000: MODES="S": GOTO 480
460 HLDLFREQ=VAL(LEFT$(FREQS,A-1))+1000
470 MODES=RIGHT$(FREQS,1)
480 LOCATE 12,18: PRINT FREQS " ": FKEY=0
490 REM Mainstream code. Inputs are from function keys and letters.
500 INS=INKEY$: IF INS<>" " THEN 1340: 'Select a freq
510 IF FKEY=0 THEN 500
520 IF FKEY=1 THEN 1470
530 IF FKEY=14 THEN 1520
540 IF OLNE=0 THEN LOCATE OLNE,58: PRINT " ": OLNE=0: SUB2=0
550 IF FKEY=5 THEN 230
560 TGL=0
570 IF FKEY=9 THEN 820
580 IF FKEY=10 THEN 960
590 GOTO 480
600 REM F1=Decrement frequency by 10 kHz.
610 FKEY=1: HLDLFREQ=HLDLFREQ-10
620 FREQS=STR$(HLDLFREQ)
630 FREQS=RIGHT$(FREQS,LEN(FREQS)-1)+". "+MODES
640 FREQS=LEFT$(FREQS,3)+". "+RIGHT$(FREQS,LEN(FREQS)-3)
650 GOSUB 40000: IF STAT%=0 THEN GOSUB 42000: RETURN
660 IF FKEY=1 THEN HLDLFREQ=148110: GOTO 620
670 IF FKEY=2 THEN HLDLFREQ=143000: GOTO 620
680 IF FKEY=3 THEN HLDLFREQ=148115: GOTO 620
690 HLDLFREQ=143000: GOTO 620
700 REM F2=Increment frequency by 10 kHz.
710 FKEY=2: HLDLFREQ=HLDLFREQ+10: GOTO 620
720 REM F3=Decrement frequency by 5 kHz.
730 FKEY=3: HLDLFREQ=HLDLFREQ-5: GOTO 620
740 REM F4=Increment frequency by 5 kHz.
750 FKEY=4: HLDLFREQ=HLDLFREQ+5: GOTO 620
760 FKEY=5: RETURN: 'Enter new frequency
770 FKEY=6: MODES="": GOTO 620: 'Set transmit offset to -600 kHz
780 FKEY=7: MODES="S": GOTO 620: 'Set transmit offset to Simplex
790 FKEY=8: MODES="+": GOTO 620: 'Set transmit offset to +600 kHz
800 REM F9=Scan frequency down by 10 kHz until a signal is heard
810 FKEY=9: RETURN
820 HLDLFREQ=HLDLFREQ-10
830 FREQS=STR$(HLDLFREQ)
840 FREQS=RIGHT$(FREQS,LEN(FREQS)-1)+". "+MODES
850 FREQS=LEFT$(FREQS,3)+". "+RIGHT$(FREQS,LEN(FREQS)-3)
860 GOSUB 40000: 'Because of delay, check if old freq came alive (line 475)
870 IF STAT%=2 THEN HLDLFREQ=148110: GOTO 830
880 IF FKEY=9 THEN FKEY=0: GOTO 900: 'Ensure start of scan over active freq
890 IF (INP(PORT+1) AND 128)=0 THEN HLDLFREQ=OFREQ: GOTO 500
900 GOSUB 42000: OFREQ=HLDLFREQ
910 LOCATE 12,18: PRINT FREQS: FOR I=1 TO DELAY: NEXT
920 IF (INP(PORT+1) AND 128)=0 THEN 500
930 AS=INKEY$: IF AS="" THEN 820 ELSE 500
940 REM F10=Scan frequency up by 10 kHz until a signal is heard
950 FKEY=10: RETURN
960 HLDLFREQ=HLDLFREQ+10
970 FREQS=STR$(HLDLFREQ)
980 FREQS=RIGHT$(FREQS,LEN(FREQS)-1)+". "+MODES
990 FREQS=LEFT$(FREQS,3)+". "+RIGHT$(FREQS,LEN(FREQS)-3)
1000 GOSUB 40000: 'Because of delay, check if old freq came alive (line 575)
1010 IF STAT%=2 THEN HLDLFREQ=143000: GOTO 970
1020 IF FKEY=10 THEN FKEY=0: GOTO 1040: 'Ensure start of scan over active freq
1030 IF (INP(PORT+1) AND 128)=0 THEN HLDLFREQ=OFREQ: GOTO 500
1040 GOSUB 42000: OFREQ=HLDLFREQ
1050 LOCATE 12,18: PRINT FREQS: FOR I=1 TO DELAY: NEXT
1060 IF (INP(PORT+1) AND 128)=0 THEN 500
1070 AS=INKEY$: IF AS="" THEN 960 ELSE 500
1080 LOCATE 24,1: PRINT "F1=-10 F2=+10 F3=-5 F4=+5 F5=Freq ";
1090 PRINT "F6=- F7=S F8=F9=SCAN F10=SCAN ";
1100 PRINT "AT=Tgl " CHR$(25) " " CHR$(24): RETURN
1110 REM Get and display frequency list.
1120 DIM RPTFREQS(24) 'Up to 24 frequencies
1130 SUB=1
1140 OPEN "I:", "FTRSCAN.DAT" 'Get frequencies and edit
1150 IF EOF(1) THEN GOTO 1230
1160 LINE INPUT #1,FREQS
1170 GOSUB 40000
1180 IF STAT%=1 THEN 1310
1190 IF STAT%=2 THEN 1320
1200 RPTFREQS(SUB)=FREQS
1210 SUB=SUB+1
1220 IF SUB<25 THEN 1150
1230 IF SUB=1 THEN RETURN 'Print the frequencies
1240 SUB=SUB-1
1250 FOR I=1 TO SUB
1260 LOCATE I,60
1270 PRINT CHR$(I+64) " " RPTFREQS(I);
1280 NEXT I
1290 OLNE=0
1300 RETURN
1310 PRINT "Frequency syntax error!": END
1320 PRINT "Invalid frequency!": END
1330 REM Select list frequency via alpha.
1340 IF INS=CHR$(20) THEN 1560: 'CTRL-T - toggle repeater inputs
1350 IF INS="A" AND INS<="V" THEN SUB2=ASC(INS)-64: GOTO 1380
1360 IF INS="a" AND INS<="v" THEN SUB2=ASC(INS)-96: GOTO 1380
1370 GOTO 500
1380 IF SUB2>SUB THEN SUB2=0: GOTO 500
1390 IF OLNE>0 THEN LOCATE OLNE,58: PRINT " ";
1400 OLNE=SUB2
1410 LOCATE SUB2,58
1420 PRINT CHR$(16);
1430 FREQS=RPTFREQS(SUB2)
1440 GOSUB 40000: GOSUB 42000: GOTO 440
1450 REM Up arrow - select previous list freq.
1460 FKEY=11: RETURN
1470 FKEY=0: SUB2=SUB2-1
1480 IF SUB2<1 THEN SUB2=SUB
1490 GOTO 1380
1500 REM Down arrow - select next list freq.
1510 FKEY=14: RETURN
1520 FKEY=0: SUB2=SUB2+1
1530 IF SUB2>SUB THEN SUB2=1
1540 GOTO 1380
1550 REM CTRL-T - Toggle receive input for listening to repeater inputs
1560 IF MODES="S" THEN 500
1570 IF MODES="+" AND TGL=0 THEN 1620
1580 IF MODES="+" AND TGL=1 THEN 1650
1590 IF MODES="+" AND TGL=0 THEN 1670
1600 IF MODES="+" AND TGL=1 THEN 1650
1610 GOTO 500
1620 TGL=1
1630 FREQS=STR$(HLDLFREQ+600)
1640 GOTO 1690
1650 TGL=0
1660 GOTO 1710
1670 TGL=1
1680 FREQS=STR$(HLDLFREQ+600)
1690 FREQS=RIGHT$(FREQS,LEN(FREQS)-1)
1700 GOTO 1730
1710 FREQS=STR$(HLDLFREQ)
1720 FREQS=RIGHT$(FREQS,LEN(FREQS)-1)+". "+MODES
1730 FREQS=LEFT$(FREQS,3)+". "+RIGHT$(FREQS,LEN(FREQS)-3)
1740 GOSUB 40000: IF STAT%=0 THEN 310
1750 GOSUB 42000: GOTO 480
40000 'Convert frequency to programming word.
40010 'Entry: FREQS (f,m)
40020 'f = frequency (146.43 or 146.235)
40030 'm = mode (+ for +600, - for -600, S (default) for simplex)
40040 'examples: "146.43,S" "142.24,+" "146.76,+" "146.235,+"
40050 'Exit: WORDS (2 bytes) - corresponds to latch inputs
40055 'byte 1 contains programming for the following:
40060 'd7 = 256
40070 'd6 = 128
40080 'd5 = 64
40090 'd4 = 32
40100 'd3 = 16
40110 'd2 = 8
40120 'd1 = 4
40130 'd0 = 2
40140 'byte 2 contains programming for the following:
40150 'd7 = 1
40160 'd6 = Simplex
40170 'd5 = +600 kHz transmit offset
40180 'd4 = -600 kHz transmit offset
40190 'd3 = +5 kHz
40200 'd2 = Red LED #1
40210 'd1 = Red LED #2
40220 'd0 = Red LED #3
40230 'STAT% (error return)
40240 '0 = normal
40250 '1 = syntax error in FREQS
40260 '2 = invalid frequency (outside of 143.000 and 148.115 range)
40300 STAT%=0
40310 A=INSTR(FREQS,"")
40320 IF A=0 THEN MS="S": FREQ=VAL(FREQS): GOTO 40360
40330 IF A<>LEN(FREQS)-1 THEN STAT%=1: RETURN
40340 FREQ=VAL(LEFT$(FREQS,A-1)): MS=RIGHT$(FREQS,1)
40350 IF MS="S" OR MS="+" OR MS="-" THEN 40360 ELSE STAT%=1: RETURN
40360 IF FREQ<143.115 THEN STAT%=2: RETURN
40370 IF FREQ>148.115 THEN STAT%=2: RETURN
40380 FREQ=(FREQ<1000)/143000: OFS5=0
40390 IF (FREQ MOD 10)=5 THEN FREQ=FREQ-5: OFS5=8
40400 FREQ=(FREQ/10)<128
40410 IF MS="S" THEN M=64: GOTO 40430
40420 IF MS="+" THEN M=16 ELSE M=32
40430 FREQ=FREQ+M+OFS5
40440 FREQ1=INT(FREQ/256)
40450 FREQ2=FREQ-(FREQ1<256)
40460 WORDS=CHR$(FREQ1)+CHR$(FREQ2)
40470 RETURN
42000 'Send programming word (2 bytes) to radio interface via
42010 'Centronics parallel port.
42020 'Entry: WORDS = programming data (direct from 40000)
42030 XD=ASC(LEFT$(WORDS,1)): XC=0
42040 OUT PORT,XD: OUT PORT+2,XC: OUT PORT+2,1
42050 XD=ASC(RIGHT$(WORDS,1)): XC=5
42060 OUT PORT,XD: OUT PORT+2,XC: OUT PORT+2,1
42070 RETURN

```

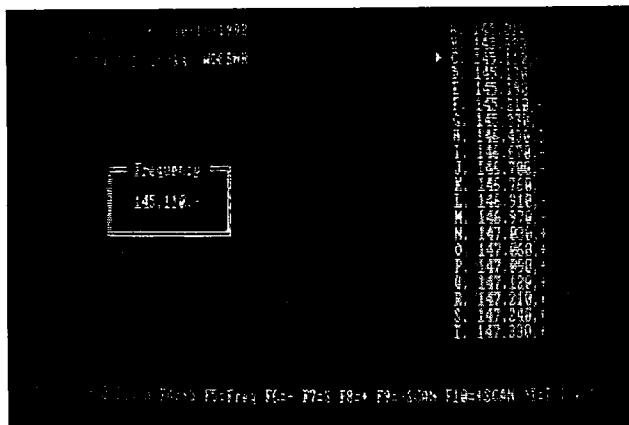


Photo D. FTRSCAN screen output on a color CGA monitor.

WORD\$ to the numeric variable FIRST. Line 42050 initializes a command variable (CMND) to set latch U3 in data input mode. Line 42060 sends the data to the latch through the printer port data register. Line 42070 sends a command through the command register to latch U3 to capture the data at its input (latch U4 is not yet selected and doesn't care what's in its input). Line 42080 sends another command to U3 to exit the input mode and "hold on" to the data at its output for pins 256 through two of the rig's synthesizer chips.

Line 42090 transfers the second 8 bits of WORD\$ to the numeric variable SECOND. Line 42100 initializes a command variable (CMND) to set latch U4 in data input mode. Line 42110 sends the data to the latch through the printer port data register. Line 42120 sends a command through the command register to latch U4 to capture the data at its input (latch U3 is not selected and is ignoring everything). Line 42130 sends another command to U4 to exit the input mode and "hold on" to the data at its output for pin 1 of the rig's synthesizer chip, the repeater offsets, the +5 kHz channel spacing, and the three status LEDs.

At all other times, the command register should contain 1 to keep the latches disabled (not loading data). The STROBE output in the printer port is inverted, so a 1 in the STROBE bit is really a low in the STROBE output pin.

When you first turn on your computer and radio, the LEDs will randomly light up. In my computer, every other LED lights up, and one or both latches may be in data input mode. I wrote a small BASIC program to initially program the interface during boot-up (Listing 2) from your AUTOEXEC.BAT file.

Using the Status Register

If you want to check if the radio is "on" using the status register, use the following sample statements (the ... represents your statements):

```
100 ISITON=(INP(PORT+1) AND 16)
110 IF ISITON=16 THEN ...: ' If radio is on.
120 IF ISITON=0 THEN ...: ' If radio is off.
```

```
100 SECOND=ASC(RIGHT$(WORDS,1)): ' SECOND = second 8-bit word
110 SECOND=SECOND OR 2: ' Turn on D2
120 MID$(WORDS,2,1)=CHR$(SECOND): ' Store change in WORD$
130 CMND=5: ' CMND = command to set U4 in receive
140 OUT PORT,SECOND: ' Write SECOND to data register
150 OUT PORT+2,CMND: ' Command U4 to receive data
160 OUT PORT+2,1: ' Command U4 to latch data
```

Listing 4.

If you want to check if the radio is receiving a signal through the status register, use the following sample statements:

```
100 RECEIVING=(INP(PORT+1) AND 128)
```

```
110 IF RECEIVING=128 THEN ...: ' If there is a signal.
```

```
120 IF RECEIVING=0 THEN ...: ' If there is no signal.
```

Programming the Status LEDs

The lower three bits of U4 control the lighting of the status LEDs. Basically, you only need to manipulate the lower 8 bits of the string WORD\$. You must maintain the first 5 bits if you want to keep the frequency and the offsets the same. The example in Listing 4 turns on status LED2.

You can use the logical operators available in BASIC to manipulate the lower three bits. The logical operators are:

```
OR to turn on an LED
AND to turn off an LED
XOR to toggle an LED
```

I encourage you to study your BASIC manual to learn more about them. They are quite easy to use once you get a handle on them. Here are some samples you can use in place of line 110 in Listing 4:

```
110 SECOND=SECOND OR 5: ' Turn on LED1 and LED3
```

```
110 SECOND=SECOND XOR 3: ' Toggle LED1 and LED2
```

```
110 SECOND=SECOND AND 248: ' Turn off LED1, LED2, and LED3
```

```
110 SECOND=SECOND AND 250: ' Turn off LED2 only
```

FTRSCAN

Listing 3 is a program called FTRSCAN. I am placing this in the public domain for your enjoyment, edification, and use. Basically, this program lets you enter a frequency, select a frequency from a list from file FTRSCAN.DAT, and scan the 2 meter band.

Initially, the program reads the FTRSCAN.DAT file (contains a list of your favorite frequencies) and lists the frequencies on the right side of the screen. The program then asks you to enter a starting frequency. After you enter a starting frequency, the program displays the frequency in the middle of the screen inside a box and lists the function keys in the bottom of the screen. Photo D shows a typical FTRSCAN display.

The following are the functions of the function keys:

F1 single steps the frequency down by 10 kHz.

F2 single steps the frequency up by 10 kHz.

F3 single steps the frequency down by 5 kHz.

F4 single steps the frequency up by 5 kHz.

F5 asks you to enter a frequency.

F6 sets the repeater offset to -600 kHz.

F7 sets the repeater offset to simplex.

F8 sets the repeater offset to +600 kHz.

F9 initiates scanning in reverse direction in 10 kHz steps.

F10 initiates scanning in forward direction in 10 kHz steps.

When you enter a frequency (function F5), enter it in this format:

freq,mode

where:

freq is the frequency (xxx.xx or xxx.xxx)

mode is the repeater offset:

= -600 kHz

S = simplex (default)

+ = +600 kHz

Examples: 146.43 147.06,+ 146.76,- 146.855,- 152.00,S

Each frequency listed on the right side of the screen corresponds to an alphabet. To select a frequency from the list, simply press a corresponding alphabet. For example, press B to select the second frequency from the list.

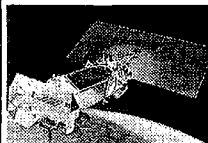
You can also move up and down the frequency list by pressing the up or down arrow key, respectively. The selected frequency is preceded by an arrow symbol shown on the screen.

You can use a word processor or text editor to create FTRSCAN.DAT, which is an ASCII file. Make sure that each frequency is followed by a carriage return and line feed. FTRSCAN will handle up to 24 frequencies, which is the maximum number of lines on the screen.

You can also listen in on a repeater input frequency by pressing CTRL-T (hold down the CTRL key and press the T key). The frequency box will show the input frequency. Press CTRL-T again to restore the repeater frequency. CTRL-T will have no effect on simplex frequencies.

To exit the program, press F5 and then press the RETURN key without entering a frequency. You can exit the program and still use the last selected frequency and be able to run other programs on your PC, just so long as you do not try to "print" anything to the parallel port. If you are capable of routing printer outputs through a serial port (by using DOS's MODE command) and have a printer that has a serial port, then you can print your files and still maintain the con-

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nection of your interface to the parallel port.

The program in Listing 3 assumes you have LPT1 with a base port of 378 hexa-decimal. If you want to use LPT2 or a parallel printer port that is included in your monochrome video adapter, then change line 40 to reflect the port address. See Figure 3 for the possible port addresses.

Observations

It is very possible that stray RF will bounce around between the transceiver and your PC through the interface circuitry. All connections between the interface and the rig are shunted with 0.1 μ F capacitors. In my setup, I found about 10 frequencies that are unusable because of these stray signals. Fortunately, nine of them are on unused frequencies, leaving one that sits on a packet frequency. You can block these frequencies from your scanning by creating a frequency intercept table in your program, if you so desire.

The 5106 synthesizer is slow when locking onto a new frequency. This means that you won't be able to make your radio scan quickly like today's commercial scanners. However, you can successfully scan up to five frequencies per second. The actual scanning rate can be increased or decreased, depending on the squelch setting. I found that if I turn the squelch down very near the

PARTS LIST FOR THE PC-TO-FTR146 INTERFACE

U1,U2	4050	Non-inverting buffer
U3,U4	74LS373	D-type latch
U5	7408	AND gates
U6,U7,U8	4049	Inverting buffer
U9	7808	8-volt regulator
U10	7805	5-volt regulator
Q1-Q13	2N3904	Switching transistor
R1-R11	15k	
R12-R29	470 ohm	
R30-R44	10k	
R45-R57	1k	
C3-C4	0.01 μ F	Regulated supply
C1-C2, C5-C7, C23		
C25, C27-C29	0.01 μ F	Bypass capacitors for U1 through U8
C24, C26	25 μ F	
C8-C-22	0.1 μ F	
D1-D18	LEDs	5 red, 4 yellow, 9 green w/snap-in holders
Boards (2)	Radio Shack 276-147	(cut second board in half for LEDs)
Steel box	Radio Shack 270-274	
Cables	25-wire ribbon cable from transceiver to D-SUB plug (Radio Shack 278-773) 25-wire cable from D-SUB to interface 15-wire cable from interface to PC parallel printer port	
Hardware	Various 4-40 and #6 nuts, bolts and tooth washers	

Note: An etched and drilled PC board is available for \$9 + \$1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Most parts are available from Radio Shack and JDR Microdevices.

threshold, the interface will scan faster. You can experiment with line 50 in Listing 3 to change the scanning rate. This rate works fine in my PC-XT running a 8088 CPU at 10 MHz, however you will need to significantly increase this value if you are using a much faster machine based on a 386 or a 486 processor.

Well, my dream of controlling a 2 meter rig using my PC is now a reality. One of my many projects is to develop a TSR (Terminate and Stay Resident) version of FTRSCAN so while working on another program I can use a hot-key to activate FTRSCAN, change a frequency, and return back to what I was doing. The list of software ideas is only limited by my imagination.

73

HAM HELP

Number 24 on your Feedback card

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS Special Events Message Area, #11. (2400 baud, 8 data bits, no parity, 1 stop bit.) Tel. (603) 924-9343. Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

I want to contact Heathkit SB series owners/collectors interested in exchanging equipment, parts, manuals, or information. Contact Bob Schlegel N7BH, 2303 286th St. East, Roy WA 98580.

NEEDED: Manual/schematic, or a copy, for a KDK 2 meter mobile radio, Model #2033. Rick Labrecque

N1ITN, RR#1 Box 990, Dixfield ME 04224.

I am looking for a copy of the schematic diagram for a Conar Model 452 (two meter) transceiver. This radio was supplied as a kit for a National Radio Institute correspondence course in the late 70s. I will pay all costs. William Fritzsche K0SDZ, 1512 W. California Ave., St. Paul MN 55108.

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

If you are anything like me (a dedicated ham), you like to receive things in the mail, such as: ham magazines, QSL cards with an SASE, letters from loved ones and friends, ham equipment catalogs, etc. I also enjoy receiving mail from other hams throughout the world, passing on important information about happenings in their area of a country or of the country itself. And what I enjoy even more is passing that information on to the thousands of readers of 73.

I have been blessed with many great Ambassadors through the three-plus years I have been putting this column together. Some have come, and some have gone. Some have become just too busy to keep it up and some just got tired (I guess). Some have become Silent Keys. Some have moved to other locations and haven't got settled in yet.

Some countries just haven't really gotten started with ham radio, either from the beginning or after changes in

political status, so there are no hams to pass the information on. Some countries are in such political and economic tangles that those in power or who have the money to be involved in amateur radio are too busy with other things to pass on ham information.

I used to think that being busy leaves no time to do other things, but I think I have proved this wrong. Some of the best college students I have seen in my teaching career have been very busy in campus activities and athletics. I have learned from them that they make plans and make every minute count. Being busy doesn't mean that there is no time for fun things; to the contrary—these students just plan properly to make everything happen.

What does this discussion have to do with ham radio? What I have been leading up to is that every one of us does have time to do many things, even if we think we are too busy. All it takes is a little planning. How long does it take to gather some ham news in one's area and write a half-page or page about it? How much time does it take it is done three or four times a year? I

don't think it takes THAT much time over a one-year period. Is that any excuse to not become a Ambassador for your country? NO! What if your English is not so good? Is that any reason not to become a Ambassador for your country? NO! I think I've done a good job so far in deciphering the reports from other countries.

So, as you can see from the previous arguments, there is no reason for you not to volunteer to become a Ambassador for your country. And the rewards: You get your name in print and get a free airmail subscription to your favorite amateur radio magazine, 73 Amateur Radio Today. And, last but certainly not least, the rest of the world gets to find out what is happening in your country. I think that is one of the most rewarding things about this job, besides working with the great people at 73. Even if you don't want to become a Ambassador, send me some information anyway.

Don't put it off; write me today, either at the magazine address or at the address at the beginning of this column. Send a small sample of your writing. Better yet, send me some information about what is happening ham-wise in your area. Do it today! Get involved in this great hobby of ours!

73 for now.—Arnie, N1BAC

Roundup

IARU Region 3 It has been an-

nounced that China has decided to allow individual amateur stations to operate after December 22, 1992. The call-sign prefixes will be BA, BD, and BG. The Chinese Radio Sports Association has been working on this for many years.

Philippines On behalf of the officers and members of the Benguet Amateur Radio Operators Network Society and the Texas Instruments Amateur Radio Club, we wish to express our profound gratitude for the publication of the information regarding the Special Event Station 4G2BAG commemorating the 83rd founding anniversary of Baguio City, Philippines.

As an additional note, we wish to inform all readers that Alvin 4F2AWE, one of the participating stations for the special event and the president of BARONS, Inc., became a Silent Key last 31 October 1992, at the young age of 24.

Russia/USA Downloaded from packet: The R&R Callsign Database containing 30,780 names and QSL addresses of stations in Russia and the independent republics is available for downloading free-of-charge from the Mountain Retreat BBS at (408) 335-4595. LLBS Sysops can FREQ the file R&RCALLS.exe. Anyone can download the file without upload restrictions or BBS registration. The program and data are shareware. The file is almost 1 megabyte long, so call in during cheap time.

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SW1-12M \$34	Xtals: 28110, 28060, 24900, 21160, 21110,	
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Israel

The "A-Team" Outfoxes the Foxes
Almost all summer long serious intentional QRM plagued the main Tel Aviv 2 meter repeater. All but the strongest stations were at the mercy of some QRMers who seemed to be dedicated to systematically making life miserable for anyone wanting to use the machine. The lowlifes even QRM'd hams who, after being run off the R7 machine, went to other repeaters. Your faithful scribe was one of the unfortunate victims. On a few occasions the weekly Israel Amateur Radio Club net was disrupted.

There were some partisan attempts to nab the offenders, but alas, the interference persisted. Only once the trackers got organized and started to work as a team did they get successful. In this way, two offenders were tracked down and only then were legitimate contacts heard on the Tel Aviv R7 repeater.

On the weekly "Gal HaMeshudar," the IARC Newsmagazine on the Air, Tuvia 4X4GT, presiding as master of ceremonies, promised that soon the IARC would announce the name of the pirate whom the club's task force tracked down and caught. The IARC

has applied to the proper authorities and filed an official complaint.

The pirate, who interrupted communications on the Tel Aviv R7 repeater and on the other machines, was caught operating a high-power transmitter in a moving vehicle. Tuvia said that the offender will be sued for damages caused by his interference, including preventing the officials of the IARC to transmit information to the membership on a weekly net.

Now that the task force has been formed, Tuvia said, once they go into operation it is just a matter of minutes before they can track down the interfering station. He asked hams to install rotatable 2 meter beams to help pinpoint the location of jammers, and promised that the next issue of "HaGa" will feature a multi-element quad that is excellent for foxhunting.

As if to take up Tuvia's challenge, an unidentified station began to interfere with the transmissions on the net and, as in days gone by, the net turned into a shambles. In the next few days the jammer grew bolder, taunting the amateurs, and even dosing out some of the vilest language. The jammer claimed that he was "untouchable" and that they'd never get him.

The "A-Team" went into operation again and tracked him down to his place of work where he was doing his vile deeds. The details will have to go unchronicled for the time being, for this

is still a covert operation. The methods and identities of the live foxhunters must remain undisclosed as they must maintain their tactical advantage in keeping the repeaters clean. The bottom line says that teamwork is the only way to go when you have to out-fox the fox.

4X Delegation to AMSAT-UK
4X1AS, 4X1GP, 4X1RU, 4X4JI, and 4Z4RM were at the annual AMSAT-UK Colloquium at the University of Surrey in England. About 130 participants from around the world were present to hear and speak about developments in an amateur satellite program.

Shlomo 4X1AS announced that AMSAT-Israel shall become an affiliate organization of AMSAT-UK, drawing cheers from the participants.

Much was spoken about the Phase III-D satellite project. The bird in the works will weigh half a ton and will cost 3.8 million dollars, supported by donations from amateurs all over the world, as well as by a grant from the German government. The Spanish Amateur Radio Organization has pledged 10,000 Sterling to the project.

Many amateurs are benefiting from hamsats unknowingly. A lot of international packet radio forwarding is being done over a few of the "microsats," thus sidestepping the fickle and congested high frequencies. Thus, we would do well by offering our financial support to our nearest AMSAT organization, which

shares the responsibility for the building and launching of these satellites.


Above and Beyond the Call! The Huleh Valley hams let nothing get in their way when it comes to having full participation at their meetings. When it turned out that Eddie 4X6TE of Kibbutz Kfar HaNasi had guard duty the night of their scheduled get-together, the hams moved tables, chairs, food, and drink into the guard house and held their meeting there.

National Field Day A national Field Day was held on September 19th. In the north, a station was set up in the Carmel Forests; in the center at the Silent Key's Forest at Ben Shemen; and in the south at the Yatir Forest north of Heer Sheva. Besides the operation on the HF and VHF bands, there were the traditional burnt offerings of steaks and shish kebabs.

Holy Land DX Contest 1992 Results The IARC Contest Manager, Shalom Beitcher 4Z4UT, has tabulated all the results of the past Holy Land DX Contest, which was held on April 18th, 1992. Participants from 27 countries on four continents sent in 247 logs which have been checked and the winners are hereby declared in order (1-2-3): Worldwide Hams—LY2WW, UA6JD, LY3BP; SWLs—LYR1751, ONL383, SP9-4006-KA; Israel—4Z4DX, 4X4KK, 4X4JU. A booklet of the complete re-

Continued on page 76


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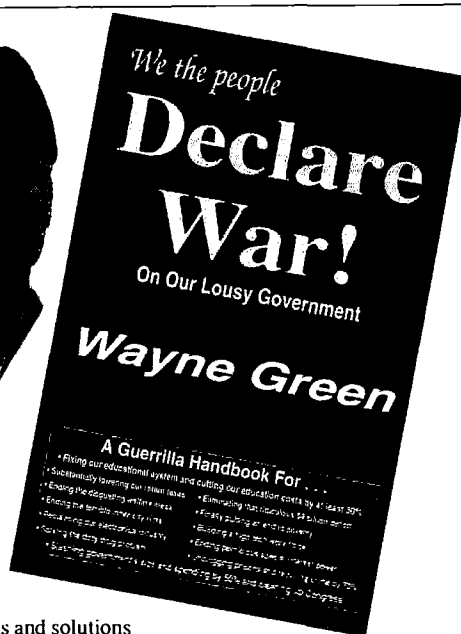
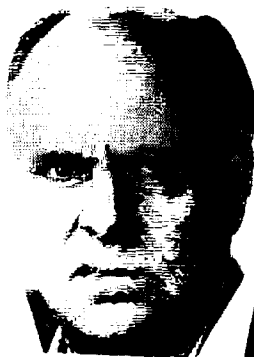
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73 INTERNATIONAL

Continued from page 75

suits of all participants is being compiled and will be available from the Israel Amateur Radio Club.

PEOPLES REPUBLIC OF CHINA

Rick Hunter, Chief Op. BY1QH
Room 316, Building 25
Tsinghua University
Beijing 100084

Peoples Republic of China

Four of the main members of the Tsinghua University Amateur Radio Club (TUARC), Rick, Hao, Jaro, and Mes, went to BY1PK for a friendly visit November 20.

We were warmly received by Mr. Tong Xiaoyong, the president of this Number 1 station in China. We were deeply impressed by their ICOM IC-781, 2 meter repeater, SSTV rigs, and much more. We learned quite a bit about the latest developments of ham radio in China and throughout the world. Mr. Tong kindly presented us with some amateur radio related computer programs and PBBS documents. Many of these programs were written by Mr. Yan, another senior op at BY1PK.

Our ham radio class that started December 1st is going very well. Jean, Violet, Nick, and Gray (not Gary, hi!) have been taught the basics of amateur radio and the international phonetic alphabet by Rick. The four students will be practicing real-time operations on SSB shortly and are looking for voice partners to help. Please listen for them on BY1QH.

We are now receiving responses from around the world, thanks to packet and 73. Several of the latest

are Immo DK6CC and Johann ZS3AAK. We are very happy to hear that Immo is interested in learning languages also.

We have surprisingly found that the RTTY propagation is no less than perfect between the USA and Beijing at about 0000 UTC. Although we can't promise a strict schedule, we will attempt contacts on 20 meters whenever available. Don't forget to check your local DX packet cluster for spots.

BY4AA, founded on October 12, 1983, is one of the most famous stations in China and is the ARS of Shanghai Radio Sports Association, located in the biggest city in BY-land. BY4AA runs CW, SSB, SSTV, packet, and a 2 meter repeater. Many member hams participate regularly in CQWW and WPX contests. Every New Year's Day, a Shanghai-Yokohama sister-city link is established with JH1ZCT. The current president is Mr. Xu Ru and the chief op is Mr. Hu Songqing. For further information, contact BY4AA, PO Box 085-205, Shanghai.

BY1QH is currently registered at the following three BBSs: JA5TX.JPN.AS; BV5AG.#APL.TWN.CHN.AS; VE7CIZ.#VANC.BC.CAN.NA. TUARC has almost daily access to all of them. Those who can not contact these BBSs directly can pass messages through DK0MHZ and ZSSS in Europe and Africa, which will then pass those messages onward.

And lastly for this month, our thanks to Wen-Long BV3AC for his kind offer of help in our search for the 2SC2652 transistor we need; to George VE7CIZ and Werner, the Sysop of DK0MHZ, for their great jobs; to Amie N1BAC for his frequent concern about TUARC; and to Joe ZSSS for his kind offer to put our newsletter into the ZS packet network. Finally, thanks to Mitsuo JA5TX and Katy BV5AG, without whom nothing could be achieved.

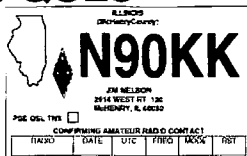
Comments and news are certainly welcome. Moreover, please don't hesitate to ask if TUARC can be of any help to you. Remember, you have quite a few friends in Beijing. 73 from Rick and the TUARC.

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Ham Doings Around the World

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MAR 6

TEXARKANA, TX The Four States ARC will sponsor its 4th annual Hamfest at the YWCA Bldg. Doors open at 8 AM. VE Testing at 1 PM. Talk-in on 146.62. Contact *Travis K5AVH, FSARC Hamfest, 1260 Canadian Texarkana TX 75503. Tel. (903) 792-2080.*

MAR 12

ST. LOUIS CITY, MO The Jefferson Barracks ARC will hold their 33rd annual Radio Auction at the Concordia Turner's Hall, 6432 Gravois. Doors open at 5 PM, the auction starts at 7:30 PM. Contact *Vivian K. Scott WD0EMS, 4121 Fabian Dr., St. Louis MO 63125. Tel. (314) 631-4068.* Talk-in on 146.94 and 145.21.

MAR 13

FLEMINGTON, NJ The Cherryville Repeater Assn., II, will host its annual Flemington Hamfest from 8 AM-2 PM at the Hunterdon Central High School Field House. Talk-in on 147.375+. Contact *Keith Burt KF5FK, P.O. Box 308, Quakertown NJ 08868-0308. Tel. (908) 788-4080.*

SCOTTSDALE, AZ The A.R.C.A. Spring Hamfest will be hosted by the Scottsdale ARC from 7 AM-4 PM at Scottsdale Comm. College (East parking lots) 9000 E. Chaparral. Talk-in on 147.18 and ZIA Link. Contact *Ron Avery WB6PEB, Hamfest Chairman, 9039 N. 127 St., Scottsdale AZ 85295. Tel. (602) 391-2388; FAX (602) 451-3876, or write to S.A.R.C. Hamfest, P.O. Box 10878, Scottsdale AZ 85271-0878.*

MAR 13-14

CHARLOTTE, NC The Mecklenburg ARS will host their 1993 Charlotte Hamfest/Computerfair, and also, the 1993 ARRL Roanoke Div. Convention, at the Charlotte Merchandise Mart, 2500 E. Independence Blvd. (US 74).

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check Special Events in message Area #11 on our BBS (603-924-9343). For listings that were too late to get into publication.

There will be FCC exams by the Charlotte VEC on Sun. Contact *Charlotte Hamfest, P.O. Box 221136, Charlotte NC 28222-1136. Tel. (704) 841-HAMS.*

MIDLAND, TX Midland ARC will hold their annual St. Patrick's Day Swapfest from 9 AM-5 PM on Sat., and from 8 AM-2:30 PM on Sun., at the Midland County Exhibit Bldg. VE Exams at 12 PM Sat. Contact *N5TQU or N5UNH at MARC, P.O. Box 4401, Midland TX 79704.*

MAR 14

BRISTOL, CT The Insurance City Repeater Club will hold its annual Hamfest/Computer Flea Market from 9 AM-2 PM at Bristol Eastern High School, King St. (Rte 229). Talk-in on 146.88, 224.80. VE Exams by pre-registration only. Write *ICRC, P.O. Box 165, Pleasant Valley CT 06063.* SASE required.

INDIANAPOLIS, IN The Indiana Hamfest will open to the public at 8 AM at the Indiana State Fairgrounds Pavilion Bldg. Talk-in on 145.25. For reservations/info, send SASE before Feb. 22 to *Aileen Scales KC9YA,*

3142 Market Place, Bloomington IN 47403. Tel. (812) 339-4446. Sponsored by the Morgan County Repeater Assn.

YORK, PA The 6th annual York Springfest (Ham & Computer) will be held at the York Fairgrounds, starting at 8 AM. ARRL VE Exams. Talk-in on 146.37/97 and 447.275. Contact *York Springfest, P.O. Box 526, Red Lion PA 17356. Tel. (717) 843-7864.*

MAR 20

MARSHALL, MI The 32nd annual Michigan Crossroads Hamfest, sponsored by the Southern Michigan ARS and the Marshall High Photo/Electronics Club, will be held at Marshall High School from 8 AM-3 PM. Talk-in on 146.66 or 146.52. Get details from *Wes Chaney N8BDM, (616) 979-3433.* For reservations, send SASE to *SMARS, P.O. Box 934, Battle Creek MI 49016.*

WESTBORO, MA The Minuteman Repeater Assn. Flea Market will be held at the Westboro High School. Doors open to the public at 10 AM. Talk-in on 146.61, 449.925, 223.94. Contact *A. Morrison N1BHI, (508) 481-3878.*

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MARCH 20-21

FORT WALTON BEACH, FL The Playground ARC will hold their 23rd annual Ham/Swapfest at the Ft. Walton Beach Fairgrounds from 8 AM-5 PM. For tables, call *Jim Jajuga KD4NHQ*, (904) 651-5362 or *Freeman Pascal KA0TGN*, (904) 581-5610, or (904) 581-4699. For RV space, call *Stan Reither WD4PEU*, (904) 243-8801. To arrange meetings or reserve commercial space, write to *P.A.R.C.*, P.O. Box 873, Ft. Walton Beach FL 32549.

MARCH 21

MONROEVILLE, PA The Two Rivers ARC will hold its 21st annual Hamfest/Computer Fair at the Greater Pittsburgh EXPOMART from 6 AM-3 PM. Contact *Michael A. Kowalcheck, Jr.*, c/o Two Rivers ARC, P.O. Box 184, Greenock PA 15047.

NEW CASTLE, DE The NUR Temple, 198 S. DuPont Hwy., (RT 13 near US 40 split), will be the location for the Pen-Del Hamfest, from 8:30 AM-2 PM. Talk-in on 224.220- and 147.225+. For details, please call (215) 497-2124. Sponsored by the Penn-Del ARC.

STERLING, IL The Sterling-Rock Falls ARS' 33rd annual Hamfest will be held at the Sterling High School Field House, 1608 4th Ave., from 7:30 AM. Talk-in on 146.25/85 W9MEP Rptr. Contact *Lloyd Sherman KB9APW*, Sterling-Rock Falls ARS.

P.O. Box 521, Sterling IL 61081. Tel. (815) 336-2434.

WEST WINDSOR, NJ The Delaware Valley Radio Assn. will sponsor HAMCOMP '93, their 21st annual Amateur Radio/Computer Flea Market, from 8 AM-2 PM, on the campus of Mercer County Comm. College, Rte. 535 (Old Trenton Rd.). Talk-in on 146.077.67. Contact *HAMCOMP '93*, P.O. Box 7024, West Trenton NJ 08628. Tel. (609) 882-2240.

YONKERS, NY WECAFEST '93, the Westchester Emergency Comm. Assn's 9th annual Radio/Electronics/Computer Fair, will be held indoors at Yonkers Raceway, intersection of I-87, Central and Yonkers Ave. Doors are open from 9 AM-2 PM. ARRL sanctioned. Talk-in on 147.060 Rptr. For vendor and Tailgate registration, call (914) 962-9666, or write to *Tom WB2NHC & Jeanne N2NOY Raffaelli*, 544 Manhattan Ave., Thornwood NY 10594.

MARCH 27

ELIZABETHTOWN, KY The Lincoln Trail ARC will hold their annual Hamfest at the Pritchard Comm. Center, starting at 8 AM. Walk-in VE Exams start at 9 AM. Talk-in on 146.38/98 and 146.52. Contact *Whitey WD4GDA*, P.O. Box 342, Vine Grove KY 40175. Tel. (502) 877-2234.

MICHIGAN CITY, IN The Michigan City, IN ARC will hold their annual

Spring Hamfest/Computer Flea Market at the Rogers High School, Pahs Rd., from 8 AM-2 PM, CST. Free VE Exams. Talk-in on 146.52 MHz simplex and 146.37/97 (PL 131.8 Hz). Contact *Jack Lemley N6SYJ*, 384 Hawthorne St., LaPorte IN 46350. Tel. (219) 325-0951.

MARCH 28

BRAINTREE, MA The South Shore ARC will hold its annual indoor Flea Market at the Viking Club, 410 Quincy Ave., from 10:30 AM-3 PM. For info, call *Dave*, (617) 337-5301, evens. till 11 pm.

MADISON, OH The Madison High School at Burns and Middle Ridge Rds., will be the location for the 15th annual Hamfest/Computer Show to be hosted by the Lake County ARA. Doors open from 8 AM-3 PM. VE Exams. Talk-in on 147.210+. Contact *Roxanne, Lake County Hamfest*, 5777 Fernwood Ct., Mentor on the Lake OH 44060. Phone (216) 257-2036 weekdays from 6 PM-9 PM; weekends 10 AM-4 PM; or (216) 352-6756 weekdays 10 AM-4 PM.

APRIL 3

PERRY, GA The Central Georgia Nat'l Hamfest will be held at the Georgia Nat'l Fairgrounds. VE Exams. Talk-in on 147.3+. Contact *Central Georgia Nat'l Hamfest*, 1412A Russell Pkwy., Suite 210, Warner Robins GA 31088.

COLUMBUS, IN The Columbus ARC Hamfest will be held from 8 AM-2 PM at Bartholomew County 4-H Fairground's Women's Bldg. on State Rd. 11. Talk-in on 146.790/190. Contact *Marion Winterberg WD9HTN*, 11941 W. Sawmill Rd., Columbus IN 47201. Tel. (812) 342-4670.

LAWTON, OK The Lawton Ft. Sill ARC will hold their 47th annual LF-SARC Hamfest from 8 AM-5 PM at the Comanche County Fairgrounds (in Lawton). ARRL approved. Talk-in on 146.91/31. Contact *Bob Morford KA5YED*, 1415 N.W. 33rd St, Lawton OK 73505. Tel. (405) 355 6120.

UPPER SADDLE RIVER, NJ The Chestnut Ridge RC will host its annual Flea Market at the Education Bldg., Saddle River Reformed Church, East Saddle River Rd./corner Weiss Rd., from 8:30 AM-2 PM. Talk-in on 146.955 rptr. Contact *Jack Meagher W2EHD*, (201) 768-8360.

APRIL 4

LONGMONT, CO Boulder County Fairgrounds, Hover and Nelson Rds., will be the location for the annual LARCFEST sponsored by the Longmont (CO) ARC. Doors open from 8 AM-3 PM. VE Exams at 1 PM; Contact (303) 499-1106 for Exam info. Talk-in on 147.27/87, 146.52. For table info, SASE to *Randy Stevens N0NMD*, 5280 Cypress Dr., Boulder CO 80303.

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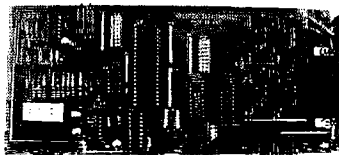
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South Eastern Michigan ARA will conduct its 35th annual Hamfest/Swap-N-Shop/Computer Show at Grosse Pointe North High School, 707 Vernier Rd., from 8 AM-2 PM. There will be an ARRL Forum and VE Exams. Talk-in on the SEMARA Rptr. 146.74(-.600). Contact *Rose Ann Mears NV8W, SEMARA Hamfest, P.O. Box 646, St. Clair Shores MI 48080-0646. Tel. (313) 881-3065.*

MADISON, WI The Madison Area Repeater Assn., Inc., will hold its 21st annual Madison Swapfest at the Dane County Exposition Center Forum Bldg. Doors open at 8 AM. Talk-in on M.A.R.A. Rptr. WB9AER, 147.75/15. Contact *M.A.R.A., P.O. Box 8890, Madison WI 53708-8890, or call Jim Waldorf KB9AQQ, (608) 249-7579.* Leave a message on the answering machine.

SPECIAL EVENT STATIONS

MARCH 13-14

ST. PATRICK (SHELBY COUNTY), OH The Farout ARC of Dayton OH will operate WB8SMC/8 from 1700Z Mar. 13-1700Z Mar. 14, to celebrate St. Patrick's Day. Frequencies: 80, 40, 15, 10m Novice CW; 20m General CW; 80, 40, 20, 15m General phone; 10m Novice phone, as band conditions dictate. Send a business size SASE to Farout ARC, P.O. Box 9181, Dayton OH 45409-9181.

MARCH 14-15

WISCONSIN QSO PARTY Sponsored by the West Allis RAC, from 1800Z Mar. 14-0100Z Mar. 15. CW and phone. Contact *WARAC, P.O. Box 1072, Milwaukee WI 53201.*

MARCH 27-28

VIRGINIA BEACH, VA The Virginia Beach ARC will operate WA4TGF from 1400Z Mar. 27-2000Z Mar. 28, to commemorate the 102nd Anniversary of the *Norwegian Lady*. CW: 10 kHz up from the bottom of the Novice subband; Phone: 3.880, 7.280, 14.280, 21.280, and 28.363. For certificate, send QSL and SASE to *VBARC, P.O. Box 62003, Virginia Beach VA 23462.*

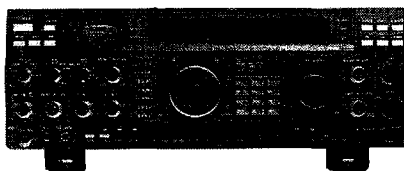
MARCH 28

SCHOFIELD BARRACKS, HI Army MARS is sponsoring a Special Event Station to commemorate the 50th Anniversary of the 442nd Regimental Combat Team. Activities are planned for all bands, all modes, including the Novice subbands. Look for us at the lower portion of each subband, 1900Z Mar. 27-1900Z Mar. 28. For a commemorative QSL card, please send your card and an SASE to *Al Shaver, Apt. #608, 84-265 Farrington Hwy., Waianae HI 96792.*

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Fortunately, the teacher or instructor who uses amateur radio in the classroom has a head start on highly motivational lessons. The traditional, "Now open your books to page 456 and read about Germany" no longer can compete with the "live action" lessons a radio teacher can provide.

Aside from making contacts with citizens from different regions of the world, children can participate in many wonderful follow-up activities which can add fun and excitement to their lessons. We all know that learning is more effective

when it is relevant and challenging to the student.

I'm in the enviable position of being able to teach across the curriculum lines in my 6th-, 7th-, and 8th-grade ham radio classes at Intermediate School 72 in Staten Island, New York. The most obvious correlation of curriculum, however, either before or after a radio contact, is with geography skills. I'll share some of the best and most effective geography activities I've used with my youngsters through the years. The basic premise of each lesson can be modified to fit the needs and abilities of different age groups.

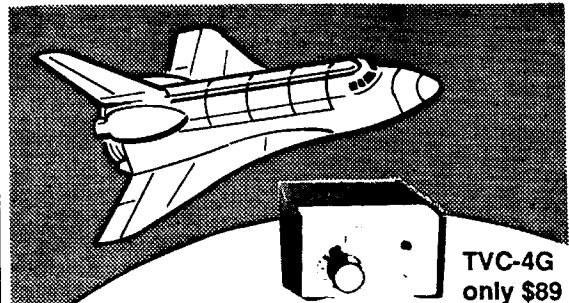
Pumpkin Globes

First, I refer you to my column "What Next?" in the February 1992 issue of *Radio Fun* magazine. In it I share a really funtastic lesson where I have the kids bring in pumpkins and water-soluble markers. (This is a great project to do in the fall, right around Halloween). I divide the class into groups. Each group is provided with a globe which will be the model for their "pumpkin globes." This follows a discussion about the differences between a wall map and a globe. Surprisingly, few children could articulate the different purposes of each. For example, the globe shows only half the world at



Tom KB2NJZ points to a spot on the wall map where the class just made a contact

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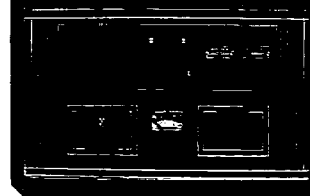
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one time, but it is more accurate in distance, direction, size and shape.

The children use the markers to produce a pumpkin that has North and South Poles, the equator, the prime meridian, the seven continents, and the four major oceans. Everything gets labeled, including their own location. It's advisable to initiate this project rapidly, because the pumpkins have a tendency to spoil quickly in a warm classroom.

The World Carpet

Several years ago I picked up a World Carpet at a local flea market. I spread it on the floor and let a group of students enjoy the "world at their feet." The floor map is a fun way for the kids to locate different areas that we're studying about. Each class gets to make up its own game to play on it. We now have quite a repertoire of games that have been created.

DX Activities

Sometimes when propagation is really good for us on the CQ All Schools net I let the children select their favorite DX contact of the month. I then have them plan a trip to that country or part of the world. They utilize language arts skills by writing letters to their radio contacts for more information, and to embassies and tourist bureaus for brochures. Youngsters are taught library and research skills to help them locate addresses. They must present an oral report describing the route they will take to get to

their destination, the budget (an itemized account of expenses), and a scrapbook which highlights the points of interest to visit in that area.

I often work with the social studies teachers to better coordinate a stimulating introductory lesson or to follow up a geography lesson in a meaningful way. Current events takes on a whole different level of relevance when the radio can bring worldwide events into the classroom. After a radio contact with a school that had just experienced an earthquake tremor in Southern California, my classes brought in over 50 projects of every type and description that portrayed interesting facts about earthquakes.

The kids especially enjoy speaking with other young people their own age. They are always surprised to learn how much they have in common, like not liking school cafeteria food, and worrying about grades. They delight in uncovering their differences and eagerly look forward to receiving letters and pictures from children far away.

Make It Interesting and Relevant

Geography is an important part of a school's curricula and, like everything else you do in the classroom with the radio, it should be presented in a creative and meaningful way.

There are always interesting events going on all across the country that are designed to stimulate school children's awareness of geography. The following list may provide you with just the thing

you're looking for to add some "zip" to your lessons. Please write to me and let me know if you have success with any of these activities and tell me how you used it in your classroom.

Nystrom is offering a *free map of the Commonwealth of Independent States*. Contact the Nystrom Map Co. (3333 Elston Ave., Chicago IL 60618-9949) to request a copy of the map. Quantities are limited.

American Express is sponsoring the *American Express Geography Competition*. It offers over \$100,000 in prize money. This year students in grades 6 through 12 are eligible to participate in this exciting, challenging program. Call 1-800-395-GLOBE, Monday through Friday 10 a.m. to 7 p.m. Eastern time, for details or to obtain entry materials for the competition.

From October 6, 1992, to March 7, 1993, The Cooper-Hewitt National Museum of Design at 2 East 91st Street, New York City, will host an exhibition of more than 400 historic and contemporary maps dating from 1500 B.C. to the present. *"The Power of Maps"* examines the significance of maps as instruments of communication, persuasion, and control. It will be accompanied by lectures, seminars, workshops, and tours, as well as programs designed for schools, teachers and families. For more information, call Deborah Perlberg at (212) 860-6868.

World Map-A-Thon is a two-week program you can run anytime from Oc-

tober through April. It is sponsored by Save The Children, a private, non-profit, non-sectarian organization which has served impoverished children and their families since 1932. During the first week, students study the nations of the world and ask relatives and friends to pledge donations based on how many countries they will be able to identify. During the second week, students get to see what they've learned, collect their pledges, and receive their own world maps to take home. For more information, contact Linnah Madumaju, World Map-A-Thon, Save The Children, P.O. Box 990 Westport CT 06881-0990; 1-800-243-5075.

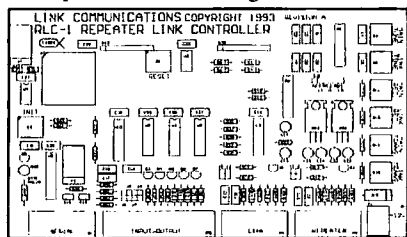
"See Me, Share My World: Understanding the Third World Through Children's Art" is a global education project of PLAN International, USA. It is a supplementary teaching unit designed for upper elementary grades. The unit is based on children's art from six developing countries that can be integrated into geography programs. Contact Meg Warren at 1-800-556-7918.

Why not make a New Year's resolution to try at least one new idea in your geography lessons?

Youth Forums

If you know of any articulate and enthusiastic young hams interested in appearing at national youth forums, have them contact me at P.O. Box 131646, Staten Island, NY 10314-0006 (718) 983-1416.

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The new model ATH-15 from Startek International is a frequency counter/frequency finder with an instant-reading RF signal-strength bar graph in a pocket-size aluminum cabinet. The fast response time and ATH™ (automatic trigger and hold) feature on this unit offer a distinctly new and improved feel to the operation of a portable frequency counter. The ATH-15 can read frequencies from 1 MHz to 1500 MHz, and the 10-segment 2"-long LED bar graph can give an instant RF signal-strength indication from signals below 1 MHz to over 4 GHz. There are two ranges with three selectable gate times on each range; maximum resolution is 10 Hz. The new ATH feature eliminates random counting

and false readings. The response time from the beginning of the input signal to a stable accurate display has been dramatically reduced.

The ATH-15 comes with factory-installed NiCd batteries. It is housed in a rugged, attractive black anodized aluminum cabinet measuring 3.5" x 4" x 1", and weighing about nine ounces. The ATH-15 is \$235, the CC-90 case is \$12 and the TA-90 antenna is \$12. For more information, contact *Startek International, Inc.*, 398 N.E. 38th St., Ft. Lauderdale FL 33334; (305) 561-2211, (800) 638-8050, Fax: (305) 561-9133. Or circle Reader Service No. 202.



AMATEUR RADIO ENGINEERING

Amateur Radio Engineering has introduced HamLink™, a telephone interface that goes between a telephone line and the computer port of your transceiver or receiver, allowing complete control of your radio. HamLink can control the frequency of a radio, mode, or band; scan memories; and operate in split mode. HamLink is even able to share a

telephone line with a family answering set without problems. You can control your transceiver from a Touch-Tone phone anywhere in the world. You can monitor DX frequencies and work the rare ones from

your office. If you live in a condo and can't have an HF station, you can put HamLink at a friend's home or a club station and use it by telephone.

HamLink is priced at \$269 and comes with a one-year limited warranty. For more information, contact *Amateur Radio Engineering, Inc.*, P.O. Box 169, Redmond WA 98073; (206) 882-2837, Fax: (206) 861-5780. Or circle Reader Service No. 201.

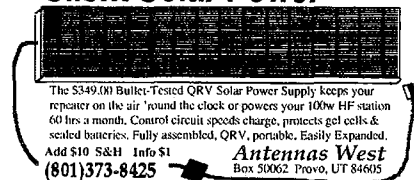
HART PUBLISHING

Hart Publishing has released the 1993 *Amateur Radio Mail Order Catalog and Resource Directory*. This is the fifth edition of this catalog and it has 250+ pages, nearly 200 categories, and more than 1,600 entries of mail-order products and services for hams. The catalog is categorized and alphabetized into easy-to-find headings from "Alternative Energy" to "Weather Instruments." Listings include the name, address, phone and fax number of the vendor, plus a description of products or services. And this year

the catalog includes "A Library of Tips" from Bill Welsh W6DDB, columnist and author, who has for many years provided the radio newcomer with easy explanations of the jargon and theories of the hobby.

The single issue price is \$14.95, plus \$3 postage via priority mail. For more information, contact *Hart Publishing*, 767 South Xenon Court, Suite 117, Lakewood CO 80228; (303) 987-9442. Or circle Reader Service No. 206.

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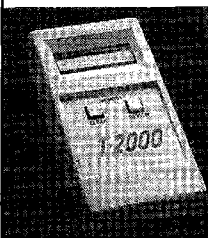
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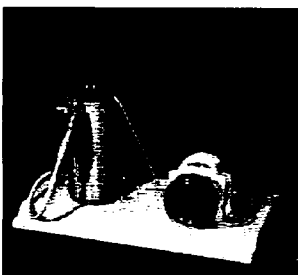
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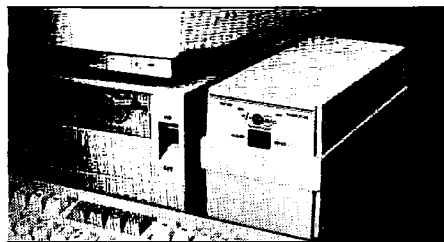
The "Pill Bottle Antenna Tuner" is priced at \$27, plus \$3 S & H, and comes completely assembled and bench tested. For more information, contact DWM ENTERPRISES, 1709 N. West Avenue, Suite 103, Jackson MI 49202; (517) 563-2784. Or circle Reader Service No. 203.

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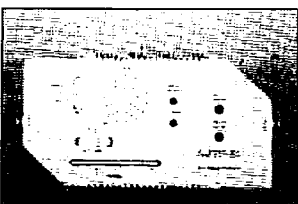
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Insurance, which provides for the repair or replacement of connected equipment up to \$25,000 if damaged by a surge, including direct lightning strikes. The suggested retail price is \$219. For more information, contact Tripp Lite, 500 N. Orleans, Chicago IL 60610-4188; (312) 329-1777, Fax: (312) 644-6505. Or circle Reader Service No. 204.



MING COMMUNICATIONS



The AUTO-ID automatic message broadcaster from Ming Communications is a solid-state digital voice recorder developed specially for two-way radios. It simply plugs in between the radio and its microphone. With the use of your radio microphone you can record up to five separate messages that can be played on the air by pressing one of the five message buttons. The AUTO-ID also has a built-in timer that

monitors your PTT activity. Record your station identification and thereafter any time you are on the air the AUTO-ID will broadcast your message ID for you. The ID's timer can be set for intervals of three or nine minutes, or it may be set to broadcast your message every time you use PTT. With the use of the AUTO-ID's built-in speaker you can monitor the message that the AUTO-ID is broadcasting, regardless of whether the selected mes-

sage was broadcast automatically or manually.

The AUTO-ID comes with plugs for an Alinco or Kenwood mobile amateur radio. There are accessories available to interface the AUTO-ID to most other types of radios. The price is \$149.95. For more information, contact Ming Communications, 2948-1/2 Honolulu Ave., La Crescenta CA 91214; (818) 249-3006, Fax: (818) 248-0840. Or circle Reader Service No. 205.

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Consumer Complaints

We get a few letters every week from hams who are having a problem, real or imagined, with one of our advertisers. Every once in awhile we are alerted to a real scam, and we quickly take appropriate action. Most of the time, though, the problem ends up being either a misunderstanding by the customer, an honest and correctable error on the part of the business, or some factor beyond the control of either that has been blown out of all proportion by one or both parties.

Even though there is little we can do about most complaints other than pass them along to the company involved (with a staff of less than 10 people, we really can't act as consumer watchdogs for the amateur industry), we are glad that our readers inform us of when they're having problems. Every once in awhile, especially if one of us here at 73 happens to be friends with someone at the "offending" company, we'll make a phone call or two to see if we can get things straightened out.

The other day I received a six-page, photocopied newsletter that was dedicated to complaining about a longtime 73 advertiser. It appears that this guy got ticked off at the company, and then sought out and found a bunch of other people who had complaints about this company, and he put them all together in this newsletter-type arrangement and mailed it out to a bunch of hams (or maybe he just mailed it to us). The thing that is unusual about this instance is that I happen to be friends with the president of the company in question and have always found him to be one of the nicest guys in the amateur radio industry. I have used his products and have never had a problem with them. In fact, my experience has been that this particular company is one of the best when it comes to helping customers who have problems or questions.

Just last week, we got a call from a reader who was having a problem getting something shipped from a mail order company. He said his check had been cashed, but he had not received his product yet, and it had been "almost four weeks." I asked the gentleman whether or not he had written to the company, inquiring about the status of his order. He said he had called, but was connected with an answering machine (with many small mail order companies being operated part-time from people's homes, this is not that unusual). I quickly looked up the ad in a recent issue, and right there in easy-to-read type was "please allow 4-6 weeks for delivery." I pointed this out to the gentleman, who didn't seem to feel that the company should cash his check before he received his product. I tried to explain how that happens, but this guy wasn't interested. By now I knew that this ham was more concerned with blatching than he was in receiving his product. I advised him to put everything in writing and send it to the company. If he didn't hear anything in two weeks, I invited him to call me again.

While it is important that you share with us any problems you're having with our advertisers, we would all be better off if you made sure you actually have a problem before asking us to look into it, or before unjustifiably slandering the name of a good company.

If you think you have a complaint, the first thing to remember is to leave a paper trail. That means all of your contact with the company should be in written form, and you must keep copies of everything. When you speak with someone on the phone, get their name and make a note of it, as well as the time and date of the phone call and what was discussed. If something important was implied or promised during the phone con-

versation, follow up the call with a letter reiterating the main points of the understanding.

Make sure you give the company sufficient time to process your order. Unless you have paid extra for next day delivery, most companies use regular package delivery or parcel post. That can take weeks to cross the country, so don't compare the speed of the company in the next town with one halfway across the globe.

If a reasonable length of time has passed (four to six weeks is pretty standard) and you still have not received your item, make a phone call and follow it up with a letter. If you have a canceled check or credit card bill that lists the company's charge, make sure you include photocopies of them. You will usually find that any delay in shipping your product to you is caused by: a) the product was shipped, but has obviously been lost in transit, or b) some part or item is on back order from the company's supplier.

A company should not charge your credit card unless they have processed the order. If your order has been shipped, the company can put a tracer on it. This might take a day or two, but it's not the company's fault. Checks are deposited on a daily or weekly basis, so it is possible that you could have received the canceled check before receiving your item. Either way, you have the right to cancel your order and receive a full refund if you haven't received the item within six weeks. You don't have to be nasty about it. Simply inform the company in writing that you are canceling your order.

If you already have the product and are not pleased with it, first make sure that it is installed correctly and that you fully understand how to operate it. A friendly call to the company will usually get you all the help you need in figuring out how to install or operate some of the complex pieces of gear we use these days.

If you truly feel that something is not right with the item, it's worth a telephone call to the company before shipping the product back to them. Remember, the company wants you to be happy with the product. That's how they stay in business. They aren't out to screw you, but if you start screaming at someone on the phone about their "piece of crap that doesn't work" you probably won't make any friends. Explain the problem you're having, and give them a chance to fix it. Don't expect the person who answers the phone to know what you're talking about. Also, don't be surprised if you get transferred around a few times or if someone offers to take a message and have your call returned later. Remember, they're trying to help you, and they are fully aware that it is in their own best interest to solve your problem.

If you have to return the item for repair or replacement, include a brief note outlining the trouble you're having and attach it to the piece of gear. Also, include a letter (keep a photocopy) outlining what you were told on the phone and asking for what you want ("Please repair and return to me . . ." or "Please return my purchase price . . .").

Only after you have exhausted all other avenues should you bother to contact the magazines. We usually can't do much except note your complaint. If we start getting a lot of complaints about the same advertiser we will look into it, but a single dissatisfied customer does not mean the company is run by a bunch of crooks.

It has been my experience that, with very few exceptions, the amateur radio industry is serviced by some of the nicest people and most honest companies anywhere. As long as we all treat each other with a little respect, I'm sure that your problems will be solved. Usually all it takes is a little communication. Isn't that what this hobby is all about?

PROPAGATION

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210 Chateau Circle
Payson AZ 85541

Traditionally, March can be a very good month for radio propagation on the HF bands. The spring equinox on March 21 brings 12 hours of darkness and daylight, and the ionosphere has good UV excitation once again. March is also a month of wind and storms so you can look forward to some days of excellent HF conditions and good weather, as well as some days of very poor propagation and weather. The daily chart shows the poorest propagation conditions during the week of March 7th to 14th. "Good" propagation is expected between the 22nd and 28th, while only "Fair" propagation is anticipated for the rest of the month, when conditions may be very unsettled and the ionosphere variable from day to day. Be aware of the possibility of some extreme weather on the days surrounding the 8th and the 12th. Propagation can be very good or very poor immediately following a solar flare or some other major disturbance on the sun. Usually a "blackout" is followed by a day or two of very good conditions on the HF bands. March 30th and a day either way could be "Very Poor."

Unexpected Benefits

You may have noticed that December 1992, ordinarily expected to exhibit poor DX conditions, was unusually active and a "Good" month for DX, due to the solar flux rising to values between 140 and 160, and magnetic field indices lower than usual with a quiet field. These are the conditions that prevail as this column is being prepared and—frankly—somewhat of a surprise to this author.

On "Good" (G) days, you may expect fairly good openings on north-south paths for the 10-12 meter bands, in the afternoon, and also excellent skip to Africa and the Pacific. Openings to Europe will be fewer, but good short skip from 1300 to 2300 miles during daylight hours should occur. The 15 and 17 meter bands should provide good worldwide propagation on "Good" days during the daylight hours, and excellent trans-equatorial conditions, peaking during the afternoon hours.

The 20 meter band ought to be very good from sunrise to sunset, with conditions peaking during the early morning and mid-afternoon hours. The 30 and 40 meter bands will show fine DX opportunities during the late afternoon and through the evening hours, and again in the early

morning hours. Short skip between 100 and 1,000 miles during the day, and beyond 1,000 miles at night, should prevail on "Good" days. The 80 and 160 meter bands should show fairly good DX after sunset, with 160 peaking at midnight and again just before sunrise. DX on 80 meters should be good at these times, and short skip up to 1,500 miles or so should be good during nighttime hours . . . again on the "Good" days. "Fair" (F) and "Poor" (P) or "Very Poor" (VP) days will seem almost impossible . . . with the lower HF bands affected least and the higher HF bands affected the most. Even on "Poor" or "Very Poor" days, an occasional opening may occur on north-south paths across the equator. Enjoy March; it ought to be interesting.

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	25	30	35	40	45	50	55	60	65	70
ARGENTINA	20	25	30	35	40	45	50	55	60	65	70	75
AUSTRALIA	15	20	25	30	35	40	45	50	55	60	65	70
CANAL ZONE	20	25	30	35	40	45	50	55	60	65	70	75
ENGLAND	20	25	30	35	40	45	50	55	60	65	70	75
HAWAII	15	20	25	30	35	40	45	50	55	60	65	70
INDIA	20	25	30	35	40	45	50	55	60	65	70	75
JAPAN	15	20	25	30	35	40	45	50	55	60	65	70
MEXICO	15	20	25	30	35	40	45	50	55	60	65	70
PHILIPPINES	20	25	30	35	40	45	50	55	60	65	70	75
PUERTO RICO	20	25	30	35	40	45	50	55	60	65	70	75
SOUTH AFRICA	20	25	30	35	40	45	50	55	60	65	70	75
U.S.S.R.	20	25	30	35	40	45	50	55	60	65	70	75
WEST COAST	15	20	25	30	35	40	45	50	55	60	65	70

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	25	30	35	40	45	50	55	60	65	70
ARGENTINA	20	25	30	35	40	45	50	55	60	65	70	75
AUSTRALIA	15	20	25	30	35	40	45	50	55	60	65	70
CANAL ZONE	20	25	30	35	40	45	50	55	60	65	70	75
ENGLAND	20	25	30	35	40	45	50	55	60	65	70	75
HAWAII	15	20	25	30	35	40	45	50	55	60	65	70
INDIA	20	25	30	35	40	45	50	55	60	65	70	75
JAPAN	15	20	25	30	35	40	45	50	55	60	65	70
MEXICO	15	20	25	30	35	40	45	50	55	60	65	70
PHILIPPINES	20	25	30	35	40	45	50	55	60	65	70	75
PUERTO RICO	20	25	30	35	40	45	50	55	60	65	70	75
SOUTH AFRICA	20	25	30	35	40	45	50	55	60	65	70	75
U.S.S.R.	20	25	30	35	40	45	50	55	60	65	70	75
WEST COAST	15	20	25	30	35	40	45	50	55	60	65	70

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	25	30	35	40	45	50	55	60	65	70
ARGENTINA	20	25	30	35	40	45	50	55	60	65	70	75
AUSTRALIA	15	20	25	30	35	40	45	50	55	60	65	70
CANAL ZONE	20	25	30	35	40	45	50	55	60	65	70	75
ENGLAND	20	25	30	35	40	45	50	55	60	65	70	75
HAWAII	15	20	25	30	35	40	45	50	55	60	65	70
INDIA	20	25	30	35	40	45	50	55	60	65	70	75
JAPAN	15	20	25	30	35	40	45	50	55	60	65	70
MEXICO	15	20	25	30	35	40	45	50	55	60	65	70
PHILIPPINES	20	25	30	35	40	45	50	55	60	65	70	75
PUERTO RICO	20	25	30	35	40	45	50	55	60	65	70	75
SOUTH AFRICA	20	25	30	35	40	45	50	55	60	65	70	75
U.S.S.R.	20	25	30	35	40	45	50	55	60	65	70	75
WEST COAST	15	20	25	30	35	40	45	50	55	60	65	70

*Try 80 meters.

The bands shown represent the highest usable at these times on "Good Days."

Note that the lower frequency bands open first and close last.

MARCH 1993

SUN	MON	TUE	WED	THU	FRI	SAT
	1 F-P	2 F-P	3 F-P	4 P-F	5 F	6 F
7 F-P	8 P-VP	9 VP-P	10 P	11 P	12 V-P	13 P
14 P-F	15 F	16 F	17 F-P	18 P-F	19 F	20 F
21 F	22 F-G	23 G	24 G	25 G	26 G	27 G
28 G-F	29 F-P	30 P	31 VP			

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Collapsible Quad

Satellite Dish

73 Reviews

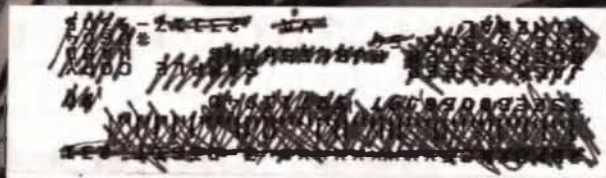
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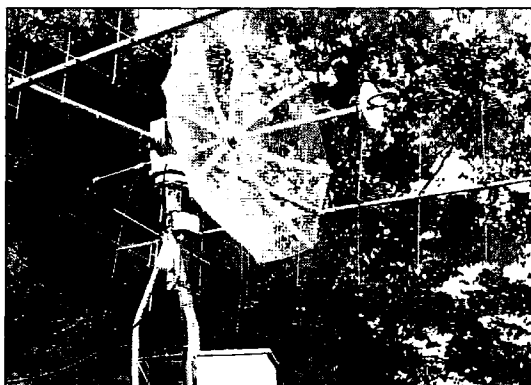
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Photo by John E.
Williams N5SJZ.

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Contract: By casting your baby-blues on this miniscule type, you have just entered into a legal and binding agreement with the staff and management of *73 Amateur Radio Today* to do something nice for a newcomer to ham radio. The nicest thing you could do would be to spend a measly \$12.97 and buy them a subscription to *Radio Fun*. That will help them get the most out of their new hobby.

NEVER SAY DIE

Wayne Green W2NSD/1

Radio Fun

Once it was clear that the no-code license was finally going to get by ARRL's stone wall, it looked as if we'd be seeing some growth in our hobby at last. That suggested three options, as far as publishing 73 was concerned. The information needs of newcomers are quite different from those of the older timers, so it would be difficult to make one magazine fit these contrary needs. Option one would be to ignore the newcomers and continue 73 unchanged. Option two would be to split it, trying to serve both groups of readers the way *QST* is doing. Option three was to go for option one and start a completely new publication totally dedicated to the needs of newcomers.

I chose option three.

To keep costs down I opted for tabloid format instead of the 73 size. This new size made use of newer typesetting systems, lower-cost presses, and much lower cost paper stock. You've probably noticed that most new publications are going for the tabloid format. I also like the flexibility of page designs the larger page provides, plus the ability to provide advertisers with more space to tell their sales story without having to charge them more.

Radio Fun was started a year and a half ago and has not just survived, despite a serious business recession, it's thrived. The reader feedback has been most gratifying. I suppose the one thing that has surprised us more than anything else is the number of older hams who are subscribing. The publication is aimed at helping newcomers not just get going in our hobby, but to discover the fantastic number of activities we have available. We mean the *fun* part, so we urge newcomers to try satellite communications, packet, RTTY, slow-scan, and so on. We want to help them get involved with club activities, to participate in contests, to get their higher-grade licenses and find out about working DX . . . perhaps even go on some DXpeditions! We want them to try traffic handling, working aurora skip, and experiment on our microwave bands. What we don't want is for them to get bogged down into a deep rut and lose interest.

There are antennas to erect, kits to build, new bands to explore, new equipment to buy and enjoy. There are flea markets, hamfests and conventions. There's even Dayton! And our

newcomers need all the hand-holding they can get to help them discover all of the wonderful things we have in store for them. How many transmitter hunts have you participated in? I guarantee you'll never forget one single hunt you get involved with. It's like going on a DXpedition . . . I've operated from a bunch of rare countries and I don't think one minute of those experiences will ever be forgotten. Navassa (twice!), Jordan, Afghanistan, Iran, Nepal, Syria, Swaziland, Lesotho, New Caledonia, Fiji, Western Samoa, American Samoa, Wake Island, St. Pierre, Thailand, Korea, South Yemen . . . oh what a flood of memories! How about moonbounce? Too difficult, eh? Not for hundreds of hams around the world.

Since about 75% of all ham equipment sales are to newcomers, the advertisers in *Radio Fun* have been cleaning up. Many tell us that they are getting far more sales via their ads in *Radio Fun* than in *QST*! And that makes sense when you see the readership statistics. Every ham newcomer gets *Radio Fun*, while only a small percentage of the newcomers are subscribing to *QST*. As a publisher, I love to see our ad sales steadily increasing. Does that mean I'll be buying a company jet? Nope, it just means that the publication will be thicker and have more articles on fun things to do and how to do them.

It also means that we need more people to help us turn out two publications instead of one, so we're interviewing for help with technical editing, advertising sales, circulation management, and all the other chores involved. We're putting *Radio Fun* out on a Macintosh desktop publishing system, which is easy to learn and fun to use. I don't know of anything we're doing where a college degree would be of much help, though an ability to read and write does come in handy. If they had a college course on meeting deadlines I might respect colleges more. But don't get me started on our lousy American educational system!

Radio Fun, like 73, is written largely by the readers. It's intended to be a communications more than an entertainment medium. If your club licenses a bunch of new hams, we want to publish a picture so we can spark more clubs into doing the same. We have far too many stick-in-the-mud clubs that need to be woken up. If you design a new piece of gear you can en-

courage others to duplicate your effort, as well as protect your idea, and perhaps even attract a manufacturer or kit supplier by writing it up. If you get involved with a new aspect of the hobby, such as satellite communication, keep notes of your successes and disasters and write it up. You'll help others to avoid the pitfalls, and perhaps inspire a few more hams to get involved.

If you buy a new piece of commercial ham gear and think others should know how much fun you're having with it, write it up. If you come up with some modifications or find some accessories, let us all know what you've done.

I don't know about you, but I don't trust most of the equipment reviews I read in the other ham magazines. They don't tell me the things I want to know . . . like what's new and different about this unit . . . what fun I am going to have with it . . . how difficult it is to get going. Things like that. I want to know how it does in the average hamshack, not at the hands of some professional writer who has more of an interest in pleasing the manufacturer than in leveling with me.

What's great about it? What's not so hot? How easy was it to set up and use? How does it compare with what you were using before? Make sense? The no-code ticket has doubled the number of newcomers, and if you can get your club to spread the word in your area we might be able to double that again. Some clubs are doing a fantastic job of recruiting newcomers. And contrary to the nabobs of negativism, these newcomers are busy learning the code so they can upgrade. The only bright side when it comes to our abundance of grouchy old-timers is that this attitude suppresses their immune systems and at least earns them their "Silent Key" award earlier than if they were fired with enthusiasm to try new things and help newcomers.

If you're not getting *Radio Fun* yet, foresooth! You can repair this serious oversight on your part by calling 800-257-2346, credit card in hand, and getting rid of a crummy \$12.97 for a whole year of fun.

About Perot

He says he's looking for good ideas. Well, my book has a ton of them, many of which have been covered in my editorials down through the years. The problem is, how can we get

H. Ross to read the book? Yes, of course I sent him a copy, but there's no sign that it ever got through to him. He's worried about the deficit. Fine. I proposed a whole new approach to solving this. He's concerned about our educational system and is looking for ideas for fixing it . . . which I've got. I propose a creative way to cut the cost of crime by about 80%, our health care costs even more than that, government expenses by 50% in five years, and so on. If you get a copy of my book, I think you'll be as excited as those who have already read it.

But how can we get through to Ross? He seems to be as insulated from the public he wants to work for as the President. Yes, I have a sneaky plan, but I need your help. Yes, you.

If you'll check out the bind-in cards in this issue you'll find one addressed to H. Ross. Tear it out, stamp it, and let's inundate him with cards. That oughta get his attention. Please note that I've left room for you to add a message of your own. Tell him what you think is the most important problem he should tackle . . . or perhaps force Clinton to tackle.

Don't let me down on this.

Dayton—Or Not?

When the invitation came asking me to speak again at Dayton, instead of automatically saying OK I gave it a good deal of thought. What are the benefits . . . to me . . . to those who spend an hour or so listening to me?

Yes, I know I usually pull a good crowd. But my interests seem far from those of most hams these days. I'm worried about America's future, and this means generating a high-tech work force for the 21st century . . . and that, to me, means the need for attracting a million youngsters to our hobby as a way to get them personally involved with technology. And in this I know I'm at odds with most hams . . . who prefer to keep our hobby as secret as possible for the enjoyment of a small, white, old, elitist group. I sense little interest in even worrying about the future, much less in trying to do something about it. It's a matter of enjoying ourselves now and to hell with all that crap about kids.

So that puts me in the role of a scold . . . and no one likes a scold. But I don't feel like I'm getting anywhere trying to interest hams in exploring the fun aspects of our hobby. When I talk about the fun of hidden transmitter hunts, instead of eyes lighting up with excitement, I see annoyance. When I talk about the fun of operating from some weird country on a DXpedition, I see eyes all over the room blinking out like Orphan Annie and Sandy, the oldest living dog in history. When I talk about the fun of experimenting on 10 GHz, making contacts from mountaintop to mountaintop, I see people leaving for more interesting talks, whatever they are.

Sometimes I talk about entrepreneurship and getting rich. This at least keeps people awake. There are so many opportunities to make big money that I get discouraged trying to cheer people on to at least give a try for the brass ring. In my book (*Declare War*) I suggest a bunch of ideas for

Continued on page 66



LETTERS

From the Hamshack

Ralph Dittmer KB9BRV, Mundelein IL. Because winter is such a dull time of the year, I decided to buy an inexpensive radio kit and build it in my spare time. I don't have much belief in most advertisements, so it was hard to decide which kit I should purchase. Most kits are way out of my price range, and I have found that the quality of many kits leaves a lot to be desired, except for a few. Also, I wonder how young amateurs can afford to build a transceiver or even a transmitter.

Anyway, I read 73 over and over again until I decided to purchase a kit from one of your advertisers, Lectorit, out of Sandusky, Ohio. When I first opened the package, I got the impression that this radio would never work very well. I proceeded to build it as the instructions said. Even if I had never built any radio, it is almost impossible not to have success with this one. The instructions are foolproof, and it is wonderful to have simple, complete, systematic steps to follow.

I do not know and have never met anyone from Lectorit but I do think these people should be congratulated for giving average-income earners a chance to be a part of amateur radio, and to build and operate a transceiver. I had my first contact with this set within 10 minutes after I completed building it. I have since had many QSOs. Thanks, 73, for pointing me to a real honest and affordable product. Also, thank you Mike Agsten WA8TXT for a nice product. Keep up the good work, 73. I will continue to subscribe, knowing that your advertisers are interested in the "everyone" in amateur radio.

Richard Bill N8ACI, Allegan MI Wayne, I have to apologize that I haven't looked at any of your magazines for a long time. Recently a friend called attention to your editorial in the August 1992 issue of 73. I am in tune with your feelings about the government-controlled educational system in this country. My background is about 19 years as an electronic engineer, most recently specializing in electromagnetic compatibility. About a year ago, due to some company politics and subsequent reorganization, I found myself out of work and over 40, thus virtually unemployed in west Michigan, where I live. This is perhaps one of those blessings in disguise, for I have been relying on a talent that I discovered through ham radio: teaching. I teach math, electricity, and electronics. My observation is that not only do our schools teach irrelevant subjects but, even worse, the system (including teachers, administrators, parents, and student peer groups) provides a very good education in an undesirable area. Even in "middle-class" areas, somewhere between about four years old and junior high school our kids learn to be afraid to learn and experience un-

derstanding. This appears to be especially true in areas of reading and technical-sounding topics like electronics, physics, and others. When I teach I strive to eliminate those fears and to open the door to real understanding, in part by making the topics relevant to the students' environment and personal goals. The longer this continues, the deeper trouble our nation gets into. My goal is to eliminate these fears introduced into real education. As a nation we can't afford to waste a lot of time getting started. It's going to take some time to turn things around.

Ray Stommel N7QAK, Seattle WA After two years, I am letting my 73 subscription lapse in April, and I want to tell you why.

It's an interesting magazine, but I don't give a hoot about building equipment from scratch, nor do I care about ATV or packet. So, that doesn't leave much in most of your issues for me.

I do care about DXing, rag-chewing and operating techniques, but 73 has precious few articles along this line.

Memo to Wayne: We finally received a negative letter for the "Letters" column. It seems that people who don't care about building or any of the newer fun modes don't care about 73. I guess there are other magazines for hams like this—hams who stopped learning and trying new things the day they got their license . . . David N1GPH

Ray, you're right. We should stop trying to get hams to try new things like packet, ATV, OSCAR and RTTY and concentrate on making them better able to chase ops in rare countries off the air (DX awards) and better able to spend the rest of their lives talking about nothing. But we do need to rewrite the regulations for this. Maybe you should take up golf, at least you'd get some exercise . . . Wayne

Gary Wagner VE7RLD, Kamloops, B.C., Canada Wayne, I just finished the February 1993 issue of 73—"Never Say Die" first, of course. I enjoy your editorials and, although they may not be what I want to hear, they all make you think! On page 76, at the end of "NSD," you have a section titled "In A Rut?" I read that with interest as you seem to have done a lot. How about this: You write that you are health conscious and healthy—how about a Shuttle flight? Imagine the contacts! I'd like to be one of them.

73 is great—keep it up. I hope to QSO one day. W2NSD/1 would be a #1 QSL card in my books.

Gary—Shuttle flight? Lordy, that would be something to brag about! Imagine using a \$23 million crapper! But why would I want to go into space

just to make a zillion 30-second contacts? Working pile-ups is okay for a few years, but even that pales after awhile and one's interest turns to looking for interesting people to talk with, and talk at length.

You say you'd like to QSO one day . . . well, that's what a letter can start. But what would we talk about? What are your areas of interest and expertise? What can you tell me that I'll find interesting? I don't want to be just a trophy to show off; I'm an interesting person to talk with and would prefer to be prized for that rather than for my location or "fame." When you want people to do something, the first step is to show them the benefit of doing what you want them to do.

I've flown around the world, visiting 25 countries as I went, and operating 20m SSB from the plane over the whole trip. I've DXed from about 65 countries so far. It would be exciting to go up in the Shuttle . . . and they'd be able to say that a 70-year-old man survived the trip (wow!). Other than that, I'm not sure of the benefits to NASA. I'll think about it . . . Wayne

Joe Mott K2UZK, Binghamton NY Wayne, after reading your August 1992 editorial and being completely in agreement with your ideas, I'd like permission to copy and distribute it to my NY State representatives as well as my federal money spenders in the feeble hope they might get some inspiration and consider some of your ideas.

Sure, give it a try, and let me know what response you get. I probably should go 50/50 on the cost of my book for anyone interested in sending copies to politicians . . . Wayne

Dan Hunt N4XAK, Chesapeake VA Wayne, I originally wrote to you back in late August, asking for ideas for a (less and less each day) disabled ham to open a business. I was pleasantly surprised at your quick response. However, you advised me to get into desktop publishing, using a Mac such as your PowerBook. Now, in the latest issue of 73, you reveal that my nads will be fried by 25 mG. With pals like you, who needs enemies?

All kidding aside, I had wanted to write and thank you for the ideas if I finally took the plunge. Well, I took the plunge, but wound up going into a wholesale/retail business for environmentally sound automotive products. My wife (N4XAM) and I are the sole owners. Much of the courage to do it came from reading your editorials, so we really appreciate the monthly pep talks. (We'll appreciate it more when we begin to turn a profit!)

Your monthly pep talks also encouraged me to volunteer to act as a mentor for an after-school technology club at one of the local schools. Most of the kids were acting like the club was something that parents had forced on them when I started my first meeting with them. By the time we were done,

they were all bright-eyed and excited about model rocketry. I built and had the kids fly a model rocket. Now they want to build and fly rockets of their own. Future sessions with them will include a trip to a natural museum, flying radio-controlled aircraft, building and flying model rockets, and amateur satellite communications. Thanks for encouraging me to do that as well. I don't know who's more excited—the kids or me!

So use your PowerBook on a desktop and irradiate that. That's what I do. And on planes I irradiate the tray table. Tell us more about how you're poisoning those poor little kids' minds with technology . . . Wayne

Dick Gobel K1CEN/0US, Fairbury NE Wayne, I just want to say how much I enjoyed your September 1992 editorial. Your comments about how socialism is destroying our country were exactly right. You reminded me of a quote I read some 40 years ago: "Never in the history of the world has a country, once started down the road to socialism, ever successfully restored its democratic form of government. Instead, it's ceased to exist."

Robert Mayer N9MRJ, Bartlett IL I have been a police officer for almost 19 years now; prior to that I was in the communications/technical end of law enforcement. After reading Sergeant Beegan's letter in the February 1993 issue, I came away with the impression that officers using radar for speed enforcement were frying birds in mid-flight and burning the hood ornaments off of passing cars.

Maybe he should have noted that law enforcement radar operates at 100 mW or less of power output. It was interesting to note that an article in the same issue, "Fun at 10,000 MHz," proposes operating at a frequency very near the law enforcement radar band at twice the power. If Mr. Beegan wishes to ban law enforcement radar for the reason that it is dosing people with radiation, frying birds and burning holes in Buicks, then the amateur radio service will also suffer the loss of those frequencies.

With the radar units currently in use, most of the officers don't even keep them on all of the time for the simple fact that many motorists have radar detectors. With a quick flip of a switch, the unit is shut down until the next vehicle's speed is checked. No fried birds or Buicks.

I do agree that we should keep after the power companies and the politicians to come forward with the facts, and not continue to act like there is nothing wrong. Facts are what we need, not vague accusations and finger pointing.

The Intermittent use of radar shouldn't do enough harm to measure, but there is plenty of evidence (facts) that prolonged use can cause serious problems for officers . . . Wayne

License Processing Delay Easing

The amateur radio license processing time delay appears to be easing a bit, according to Gordon Girtan W6NLG, who administered the Sunnyvale VEC in Northern California. Girtan says that he made a check with the FCC's Gettysburg License Processing Facility the week of January 14th and found that the processing time had dropped from the 90-120 days announced by the FCC just before the Christmas holidays to around 60 days in mid-January. W6NLG says that the FCC has processed license applications that it received on November 23rd, and that new licenses were expected to arrive on the West Coast by Monday, January 18.

Girtan noted that at Processing Level 1, the FCC has now processed all Form 610 applications that arrived prior to December 2nd. He also says that his VEC operation ships all completed applications to Gettysburg using Federal Express to minimize delay. Since many VE teams and VEC operations use standard US Mail as their delivery carrier, further delays of a few to several days are still possible. *TNX Westlink Report #642, January 28, 1993.*

Amateur Radio Scholarships

The Foundation for Amateur Radio, Inc., a nonprofit organization with headquarters in Washington, DC, plans to administer 47 scholarships for the academic year 1993-1994 to assist licensed radio amateurs. The Foundation, composed of 50 local area amateur radio clubs, fully funds five of these scholarships with the income from grants and from its annual hamfest. The remaining 42 are administered by the Foundation without cost to the various donors.

Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college or technical school. The awards range from \$500 to \$2,000, with preference given in some cases to residents of specified geographical areas or to the pursuit of certain study programs. Clubs are encouraged to announce these opportunities at their meetings, on their nets, during training classes, and in their club newsletters.

Additional information and an application form can be requested by letter or QSL card, postmarked prior to April 30, 1993, from: FAR Scholarships, 6903 Rhode Island Avenue, College Park MD 20740. The Foundation for Amateur Radio, incorporated in the District of

Columbia, is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1954. It is devoted exclusively to promoting the interests of amateur radio and those scientific, literary and educational pursuits that advance the purpose of the Amateur Radio Service.

ARRL Files Automatic Control HF Packet Petition

On February 1, 1993, the American Radio Relay League formally requested a final extension of the *Special Temporary Authority (STA)* which currently authorizes certain amateur radio stations to conduct HF digital communications under automatic control. The present STA was first issued July 7, 1987, and has been extended five times. It expired on February 3, 1993.

The League asked, however, that the STA's termination be delayed until the FCC acts on their Petition for Rulemaking (also filed February 1st) proposing permanent rules governing HF data operation under automatic control. The ARRL said they "... firmly believe that the petition will be supported by the amateur radio community as a reasonable accommodation for all concerned ..."

The petition, which has not yet been assigned a Rule Making file number, seeks to permit automatic control of RTTY and data communications in certain small segments of the 10, 12, 15, 17, 20, 30, 40 and 80 meter ham bands. The ARRL said internationally agreed upon band plan changes made the proposal both workable and acceptable to the majority of ham operators.

The League's petition runs to some 35 pages. The following is a capsule version of the points made by the ARRL.

(1.) The League's goal in submitting the petition is to encourage experimentation, development and refinement of modern automatically controlled data communications ... and to improve emergency and public service communications.

(2.) The National Telecommunications and Information Administration agrees that the Amateur Service performs a vital role in adapting complicated and expensive technologies to useful communications systems. NTIA is the White House advisor on telecommunications matters. Digital communications networks are advancing at a rapid pace.

(3.) Current data operation in the HF bands includes RTTY, AMTOR, and packet radio. The Amateur Service is also experimenting with such new spectrum-efficient error-correcting digital modes as "Clover" and "Pactor."

(4.) The current rules do not permit automatic networking below 50 MHz and third

party communications must use the AX.25 packet protocol. This requirement was based on an ARRL proposal ... although many amateurs also want automatic high frequency networking authority as well.

(5.) The FCC was properly concerned that automatic "robot" stations will interfere with locally controlled users on the high frequency bands. Several petitions for reconsideration were filed. The ARRL suggested that a small group of data communications enthusiasts determine the feasibility of permanent HF data communications.

(6.) The first STA request was granted in 1987 for a six-month period and has been renewed ever since. HF packet works well, moves traffic—and, with careful frequency selection, provides a public service without undue interference to other amateur activities. But HF packet radio is not compatible with other modes and need separate frequencies.

(7.) The League proposed a plan (RM-7248) in early 1990 that would permit automatically-controlled HF data communications based on a new IARU Region 2 regional band planning effort.

The *International Amateur Radio Union* (IARU) is the worldwide union of national amateur radio societies. It is an international organization that is recognized by the ITU as representing the amateur and amateur-satellite services throughout the world. It is comprised of 126 member societies and is organized into three Regions corresponding with those of the ITU.

The ARRL petition was withdrawn two months later to consider other options for automatic control. These options would be developed through the work of a committee of interested amateurs.

(8.) A January 1992 *QST* survey on automatic digital communications gathered more than 500 responses which were considered by the League's Board of Directors at their meeting in July. It was clear that there should be no band-wide automatic control of HF digital messaging ... any such operation should be within specific subbands. "The League was faced with the dilemma of its obligation to comply with the band plan for such established by international agreement, and the rejection of the same by United States amateurs."

(9.) The ARRL Board elected to support a plan which would not permit automatic HF data communications between, or among, themselves. Rather, such stations would be limited to communications with stations under local control. The compromise semi-automatic control was criticized as unworkable and unacceptable by HF packeters.

(10.) Once again the League's Executive

Continued on page 34

Mini-Quad Loops

Three-fifths-size loops with full-size performance.

by Dean Frazier NH6XK

Eventually a ham discovers the gain, and especially the quietness on receive, of loop antennas, and plans to construct one. Soon enough it becomes apparent that loops for the bands below 20 meters are impossibly large. A square loop on 40 meters (7.15 MHz), for example, needs sides about 35 feet long, which may be unreasonably large to erect, especially in the vertical plane. However, a loop, or any antenna, can be made physically smaller while maintaining full electrical size. This can be accomplished with loading coils, as is frequently done in mobile applications. Unfortunately, coils do introduce some loss. Another approach is to reduce the size of an antenna, e.g. cause it to be resonant above the desired frequency by mechanical shrinking, and then capacitively "stretch" it, so as to achieve the proper electrical length for resonance. The latter is the approach taken here.

The mini-quad loops described are not quite three-fifths full size, and yet, via capacitive loading, are electrically stretched to a full wave. We don't get something (size reduction) for nothing, however. We do suffer some reduction in bandwidth, and we lose about 1/2 dB compared to the performance of a full-size loop. The former limitation may only be a problem on the higher frequencies, for which bands a mini-quad loop can be tailored for a specific portion of the band. Note that the 2:1 SWR bandwidth on 12 and 17 meters (Table 1) and 30 meters is greater than the entire width of the band. Regarding the second limitation, recall that a very good human ear just might detect a 1 dB difference in received signal . . . clearly a 1/2 dB reduction with a mini-

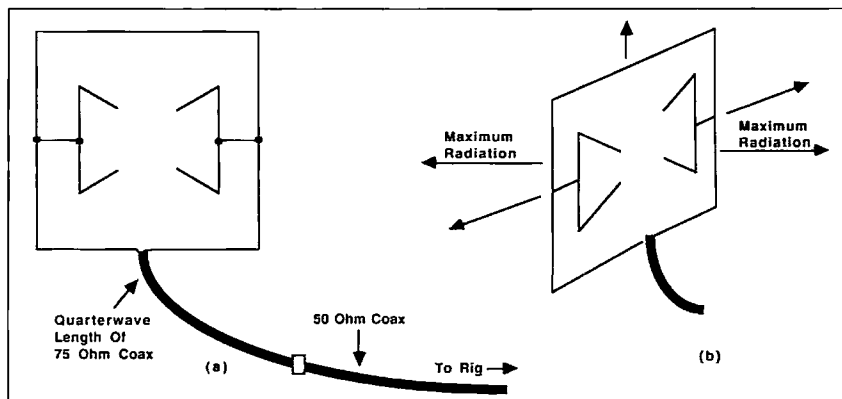


Figure 2. a) Feeding the mini-quad loop for horizontal polarization. b) Maximum radiation is off of the plane of the loop.

quad loop goes unnoticed. Contrast the "cost" of a loss of 1/2 dB, and some reduction of bandwidth, against the "gain" of a 40% size reduction. Add to this the forward gain (when mounted vertically) of several dB, and side rejection, and the mini-quad loop begins to look pretty good.

For low-angle radiation, the loop works best when mounted vertically and fed at the bottom, but if this is not possible, mount it horizontally and you can still communicate better than with a dipole. (Inspection of radiation patterns shows that while there are low-angle lobes for a mini-quad loop when mounted vertically, there is also considerable radiation in the plane of the loop. Many hams believe full-wave loops only radiate perpendicularly to the loop plane. This is just not so, and my personal experience confirms this.)

Mounted in the vertical plane, you'll have to arrange to rotate (point) the broad side of the loop; horizontally mounted, the radiation is omnidirectional. (Height and visual impact restrictions in my planned neighborhood preclude my outdoor loops being vertical . . . but I've had good success with them mounted more or less horizontally on the roof with a few inches of "standoff," and also

hung vertically on walls in the house. With a mini-quad loop on my living room wall inside the house, I have communicated as far away as Minnesota from Hawaii, with 5 watts on 12 meters.)

Construction

The dimensions shown in the tables are for wire mini-quad loops, 2-40 meters. Parameters S, p, q, and m are defined below:

S = side length, feet (The loops are square.)

p = capacitance hat inset, feet

q = capacitance hat length, feet

r = capacitance hat fold-in leg, feet

(Or inches if so specified.)

See Figure 1.

For the ambitious (those desiring to build a mini-quad loop for 80 or perhaps 160 meters, or for tailoring for a different portion of a band, such as 10 meters) the following formulae are provided:

$$S = \frac{147.917}{f(\text{MHz})} \text{ feet}$$

$$p = 0.128 \times (S) \text{ feet}$$

$$q = 0.774 \times (S) \text{ feet}$$

$$m = 0.304 \times (S) \text{ feet}$$

I feed the mini-quad loop with 50 ohm coax from the rig, terminating in a quarter wave of 75 ohm coax at the antenna feed point. For example, on 40 meters, 7.15 MHz, with 75 ohm coax (Velocity Factor = 0.75), a quarter wave is:

$$\frac{246(0.75)}{7.15 \text{ MHz}} = 25.804 = 25' 9 \frac{5}{8}"$$

See Figures 2a and 2b.

At the feed point, one end of the loop connects to the 75 ohm coax center conductor, the

Continued on page 14

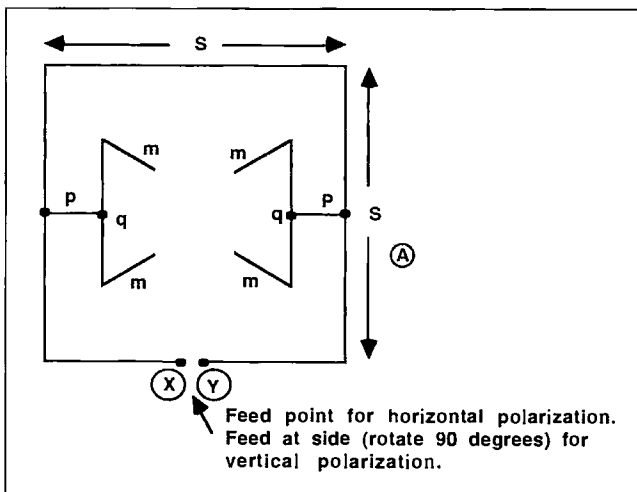


Figure 1. Diagram of mini-quad loop. See Table 1 for measurements.

Copper Dual-Band Super J-Pole Antenna

Build it in less than an hour.

by Marty Gammel KAØNAN

While looking for an antenna project to build I remembered seeing a Marine antenna called the Super J-Pole in the 1988 *ARRL Antenna Handbook*, which claimed a 6 dB gain over a quarter-wave ground plane. I didn't have a machine shop at my disposal to fabricate the parts shown in the Marine antenna article so I set about redesigning the antenna using materials that were easy to find and work with. I have had very good results working with copper J-poles, so I built my refined version of the classic J-pole. I then added a short insulating section, the extra half wave of vertical length, and the needed half-wave matching stub.

Materials

All the materials except the SO239 fitting can be found at any good hardware store, and the

whole antenna can be made in less than one hour.

In my design I use 1/2" copper schedule M tubing and 1/4" soft copper tubing. I had experimented with using a Teflon insulator, but have since changed my design to use a 9" length of hardwood dowel with three coats of lacquer as the insulator, for more strength.

Clean all the tubing, and then from the 1/2" tubing cut one piece each of the following lengths: 57-1/2"; 38"; 19"; 2", and a piece about 3" long for a stub to mount the antenna. In addition to the tubing, buy a 1/2" elbow, a 1/2" Tee, two 1/2" end caps, a 1/2" threaded fitting, and a cast iron floor flange for mounting. Get a piece of 3/16" or 1/4" soft copper tubing 42" long. Find the center of the 1/4" tubing and bend it around a 1"-to-1-1/4" diameter water pipe or dowel.

Put the Heat to It

Now fire up the torch and start the assembly process from the bottom up. See Figure 1. Use flux on all joints, solder the 1/2" threaded fitting to the mounting stub, and solder the 1/2" Tee fitting. Then proceed with the 57-1/2" section, 2" cross piece, and 19" section. Pay close attention to getting the 19" piece parallel to the 57-1/2" piece. After these have cooled, drill through both the 57-1/2" section of 1/2" tubing and the hardwood dowel about 1/4" from the top end of the 1/2" tubing, and the bottom of the 38" section of tubing. (See Photo A.) Then insert the 1/4" tubing through the 1/2" tubing and dowel assembly. Sweat solder the 1/4" tubing to the 1/2" tubing and sweat solder the end caps. After these have cooled, clean the entire antenna, bend the half-wave matching section to a half circle of about 4" radius around the antenna to help the balance and match.

Simplify the Feed Point

The feed point also needed to be made simpler, so I elongated one of the mounting holes of a panel mount SO-239 fitting and inserted a stainless steel adjustable band clamp. This goes on the 57-1/2" long section of 1/2" tubing. A short 2-3/4" length of #14 copper stranded wire is soldered to the center terminal to go over to the 19" section. I used another stainless steel clamp to attach this. (See Photo B.) While experimenting to find the proper feed point, I found that the distance above the crossbar should be about 3".

Building Suggestions

1. You may use a Fiberglass rod as an insulator, but you will have to be very careful with the torch or you may weaken or burn the rod, or make it brittle.
2. When cutting the 1/2" copper tubing, cut the 57-1/2" piece from one end of the 10' length, and the 38" piece from the other end. By doing this you will have factory-cut edges for inserting the 1/2" dowel.
3. Be sure to keep the flame of the torch away from the insulator to avoid burning it.
4. Use paste flux on all joints when fitting the pieces together. Use enough flux, since you will be cleaning the entire antenna with solvent after assembly.
5. Use a weight to hold the 19", 57-1/2", and 2" pieces, and the Tee and the elbow, flat when they are sweat soldered together.
6. Use a ruler or caliper to check the spacing

Continued on page 15

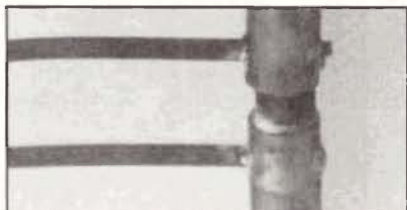


Photo A. Detail of 1/2 wave matching stub mounting.

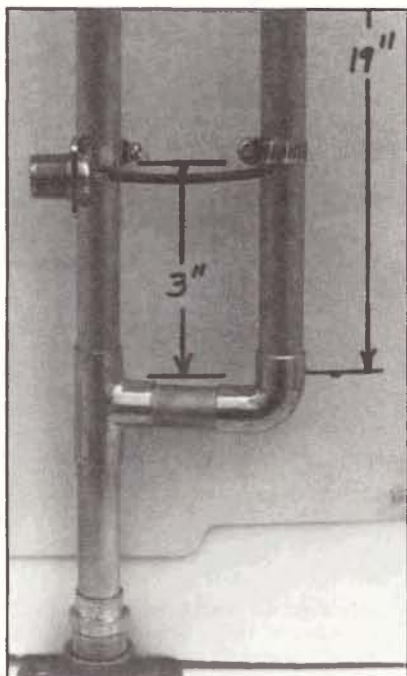


Photo B. J-Pole feed point.

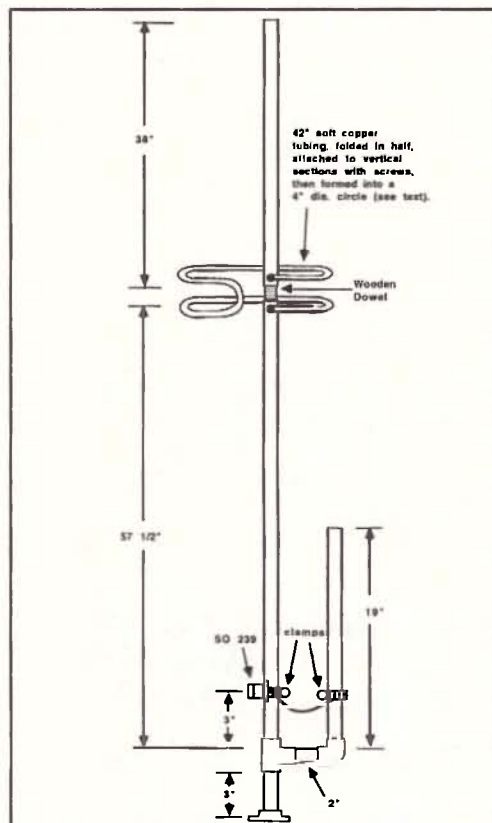


Figure 1. Dimensions for the Super J-Pole.

Mini Quad Loops

Continued from page 10

other end to the braid side. Or, you can use an S.O. connector mounted in a convenient manner (I use PVC strips).

Apartment/Condo Dwellers and/or New Hams

See Table 1 for 10 meter dimensions, Table 2 for 2 and 6 meter dimensions.

It is a simple project to mount a mini-quad loop on the wall or ceiling in an apartment, or in the attic of a house. A loop can easily be set up around a picture frame. Small wire, two

or three inches of standoff from the wall, some white paint, and/or curtains or a large picture, etc., can be used to make the loop invisible and yet still be effective.

Summary

You'll get 2-3 dB gain over a dipole, and notice much quieter reception. Build the mini-quad loops according to the dimensions supplied. Trim the capacitance legs only as necessary to achieve resonance (lowest SWR at feed point) if metal, wiring, wood, etc., in the near field of the loop cause detuning. The mini-quad loops can form the driven elements of two- or three-element cubical quad beam antennas.

Quad loops don't have to be large to be good performers. And they are "quiet."

NOTE: Mini-Quad-Loops have been constructed, tested and used on 2, 12, 20, and 40 meters, with the data of Tables 1 and 2, with good results. Initial SWRs in all cases, at the feed point, were at worst 1.5:1. Adjustment of the angle between p and m allows improvement in SWR. In each of these cases the relationships for S, p, q, and m given in the text worked—e.g.:

$$S = \frac{147.917}{f \text{ (MHz)}}$$

The table values for 5, 10, 15, and 30 meters are derived, but based on the experiments on 2, 12, 20, and 40 meters. I have no reason to believe that the derived data is not good data.

Acknowledgements: L.A. Moxon G6XN, *HF Antennas For All Locations*, reference to capacity hat loaded mini-quad by G3YDX.

$$S = \frac{147.917}{f \text{ (MHz)}} \text{ feet}$$

p = 0.128 (S) feet x 12 = inches
 q = 0.774 (S) feet x 12 = inches
 m = 0.304 (S) feet x 12 = inches
 T = Wire needed to build mini-quad-loop (includes extra for joint-wraps), feet
 B = Approximate bandwidth, kHz

Band (meters)	10	12	15	17	20	30	40
Frequency (MHz)	28.400	24.940	21.225	18.118	14.150	10.125	7.150
S (feet, inches)	5' 2-1/2"	5' 11-3/16"	6' 11-5/8"	8' 2"	10' 5-7/16"	14' 7-5/16"	20' 8-1/4"
p (inches)	8"	9-1/8"	10-11/16"	12-9/16"	16-1/16"	22-7/16"	31-3/4"
q (inches)	48-3/8"	55-1/6"	64-3/4"	75-13/16"	97-1/16"	135-11/16"	192"
m (inches)	19"	21-5/8"	25-7/16"	29-13/16"	38-1/8"	53-5/16"	75-7/16"
T (feet)	37'	42'	50'	58'	74'	103'	146'
B (kHz)	400	350	300	250	200	150	100

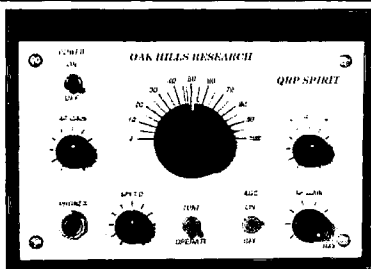
Table 1. 10-40 meters

Band (meters)	2	6
Frequency (MHz)	147.00	52.00
S	12-1/16"	34-1/8"
p	1-9/16"	4-3/8"
q	9-5/16"	26-7/16"
m	3-11/16"	10-3/8"
T	8'	20'

Table 2. 2 and 6 meters (S, p, q, m, and T as previously defined).

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Copper Dual-Band Super J-Pole Antenna *Continued from page 12*

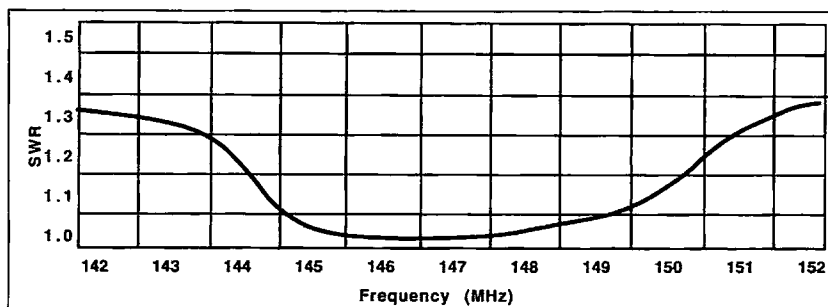


Figure 2. Antenna SWR curve chart for 142-152 MHz.

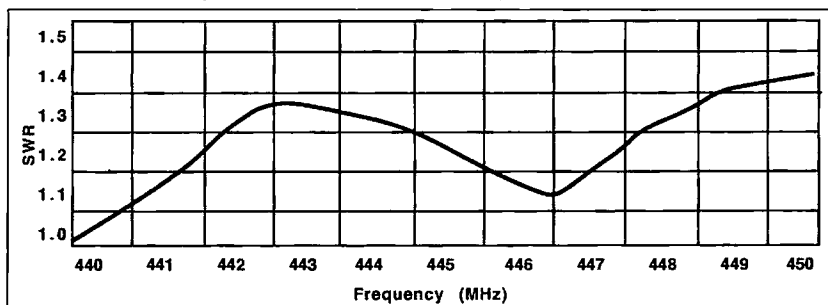


Figure 3. Antenna SWR curve chart for 440-450 MHz.

between the 19" and 57-1/2" pieces, to keep them parallel to each other.

7. When drilling the SO-239 fitting, use a drill

press. Be careful not to drill into the threads of the fitting. After the holes are drilled, file the opening flat for a better band clamp fit.

Parts List

- 1 10-foot section of schedule M 1/2" copper tubing
- 1 1/2" copper elbow
- 1 1/2" copper Tee fitting
- 2 1/2" copper end caps
- 1 1/2" copper threaded fitting (for mounting)
- 1 1/2" cast floor flange (for mounting)
- 1 Piece of 3/16" or 1/4" soft copper tubing 42" long
- 1 Piece of 1/2" hardwood dowel or Fiberglass rod
- 1 SO-239 panel mount coaxial fitting
- 1 Piece of #14 stranded copper wire
- 2 3/8" by 7/8" stainless band clamps

Tools needed:

- Tape measure
- Tubing cutter
- Propane torch
- Solder and flux
- Electrical tape
- Caulking compound
- Screwdriver
- A weight to keep parts aligned while soldering
- Steel wool or a Scotch Brite pad (for cleaning all copper)
- Spray can of clear exterior lacquer (to finish-coat completed antenna)

8. After the best match has been found, you may want to solder the SO-239 and the stranded wire end to the 1/2" tubing.

9. When the antenna has been cleaned and matched, spray the entire antenna with a coat or two of clear lacquer to keep it looking nice.

10. After everything else has been done, apply silicon or a butyl rubber compound to the insulating section, then cover the joint with electrician's tape for a weathertight seal.

11. A 1/2" pipe coupling and a length of pipe may be used in place of floor flange for mounting in a roof tripod.

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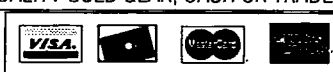
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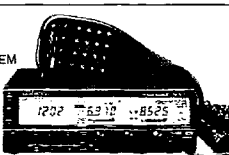
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TS-850/AT

HT's

IC-2SAT
2M 2-5W DEL MICRO

IC-2SRA
2M/SCANNER HT

IC-W2A
2M/70CM MICRO

MOBILE VHF/UHF

IC-229H
2M 45W 20 MEM

IC-2410
2M/70CM 45W DEL

HF EQUIPMENT

IC-735
HF DELUXE COMPACT

IC-785
HF DELUXE TUNER PS



IC-2410



IC-735



IC-785

HT's

FT-411E
2M 2-5W 50 MEM CTCSS

FT-470
2M/70CM 2-5W 50 MEM

MOBILE VHF/UHF

FT-5200
2M/70CM DUAL BAND

FT-2400H
2M 50W LCD CTCSS

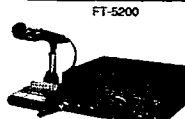
HF EQUIPMENT

FT-890
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FT-1000
HF OSL CATCHER!!



FT-5200



FT-890AT



FT-1000

CIRCLE 162 ON READER SERVICE CARD

HR2510 Hi-Power Modification

Increase the performance of this popular HF rig.

by Carl Merrill

After reading the high power modification originally published in *73 Amateur Radio Today* ("Beefing Up the Uniden and the HTX-100" by M. T. Stacey KC4HGH, September 1989, p. 48) and then changed by the original writer (*73 Amateur Radio Today*, "Updates," November 1989, p. 76), I discovered another method that is easier to implement and has given consistent results.

The modification in the 1989 article and update requires you to change the output transistor from a type 2SC477 to a type 2SC497, then change the pre-driver transistor Q134 from a type 2SC2086 to a type ECG-340.

I found that the ECG-340 didn't really give any more drive to the driver transistor, for it is an emitter-follower, with a gain of less than one, so I left the 2SC2086 portion of the circuit alone.

The Modification

The following modification will give you marked improvement in the power output of the HR2510 and is easy to implement:

1. Change the output from a 2SC477 to a 2SC497 and make the necessary bias adjustments as follows:

Connect the radio output to a 50 ohm dummy load and set the frequency to 28.005 MHz, USB mode, with no modulation.

Hook up a meter (0-100 mA scale) between test points TP4 (+) and TP2 (-) to monitor final amplifier current.

Key the transmitter with no modulation and adjust VR112 for 80 mA collector current (Q132).

Place the meter's negative lead on TP3 and check the driver current.

Adjust VR113 for a driver current of 50 mA, if necessary.

Replace shorting bars into TP4, TP3 and TP2.

While tuned to 28 MHz, adjust the AM power output to about 5 watts by adjusting VR107.

3. Turn off the power and locate Q134, the 2SC2086 amplifier transistor. Cut the foil (as shown in Figure 2) to remove the

network from the emitter. Remove the 0.01 uF capacitor (C135) from the collector of this transistor to ground. Bridge the foil from the open end of the network to the collector foil. Now, solder the removed 0.01 uF (C135) to the bottom of the board from the emitter to ground. See Figures 1 & 2 for details.

4. Check your work carefully for any solder bridges and turn on the power. The AM output will normally jump up to about 15 watts after this modification. Turn the AM power output down to about 12 to 13 watts by adjusting VR107. This is plenty for this radio and will sound real nice on the air. You should find that the SSB power will now be around 25 to 32 watts.

5. Adjust the SSB output for peak power by feeding a single 1 kHz tone (or dual tone) into the radio while adjusting VR104 (the SSB ALC pot).

6. If your radio needs further alignment, consult the appropriate service manuals for the HR2510 and the HTX-100. The 2SC497 may be obtained from RF Parts, 1320 Grand Ave., San Marcos CA 92069. Tel: (800) 854-1927 (for orders only).

Results

The purpose of this change is to make the 2SC2086 provide gain, for in an emitter follower configuration, the gain is always less than 1. It works better, and saves the cost of the ECG-340. I have completed this modification on approximately eight different radios and they work fine. They can be heard in places they couldn't reach before.

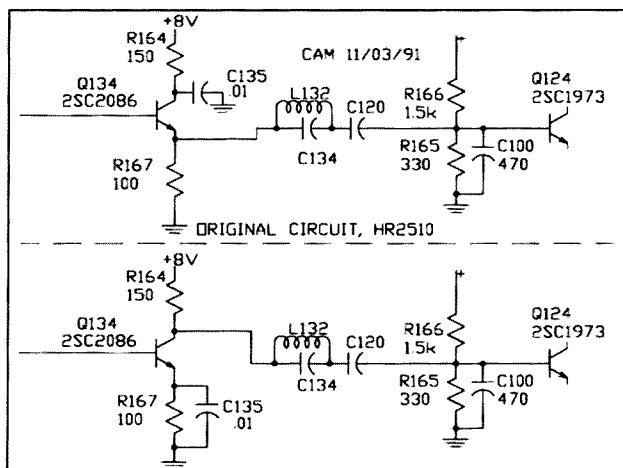


Figure 1. Modification for increased power for the Uniden HR2510. Top circuit is the original; bottom circuit is the modified version.

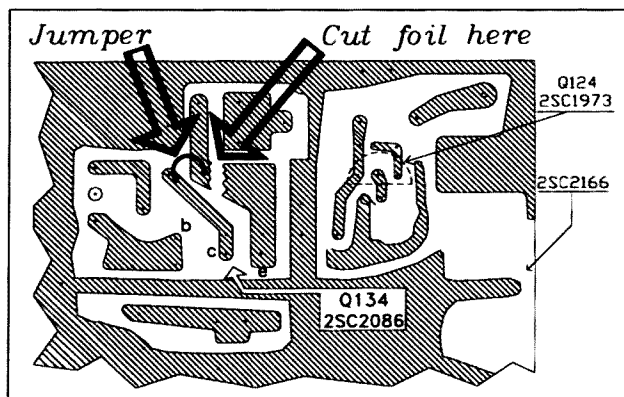


Figure 2. Modifications to the PC board, bottom view.

10 Meter X-Beam

Upgrade your antenna as well as your license.

by John E. Williams N5SJZ

After a year as no-code Techs, my wife Debby N5SKA and I decided it was time to upgrade to Tech-plus and work some DX. With help and encouragement from Joe Nunnamaker KD3VR, passing 5 wpm was much less of a chore than we had imagined. The big day was here and we had our 5 wpm Certificates of Successful Completion in hand; it was time to work the world.

I had previously purchased a small 10 meter rig and had put up a simple 10 meter horizontal dipole in anticipation of this day. Over the next few weeks, even though I made several contacts, I was not happy with the results. I felt it was time to upgrade my antenna. First I considered several commercial antennas. However, I had caught the bug for homebrewing with a 2 meter amplifier kit and had met Joe in the process, but that's another story. Since this was my first antenna project, I wanted it to be simple, high performance, and low cost. At first my criteria seemed mutually exclusive, but then I came upon an article in the *ARRL Handbook* by Brice Anderson W9PNE concerning X-Beam antennas. I spoke with Joe and told him my idea. He enthusiastically agreed to lend his expertise and help with the project.

Materials

I wanted to construct the antenna with materials I could locate at the local hardware store. So, with Joe and Debby, I paid a visit to the hardware store. For the X-beam arms, we considered aluminum and copper. We selected

copper tubing for several reasons. First, copper is less than half the price of aluminum. Second, unlike aluminum, copper can be soldered-to directly. And finally, copper has a lower resistance to radiation, perhaps giving a slight performance edge. For the center support we chose a 1/2" thick, 2' x 2' square pre-cut piece of plywood.

After purchasing the necessary materials on a Saturday, we planned to build and put the antenna on the air the next Saturday. All the materials for the antenna cost less than \$40.

Construction

The first step is to prepare the copper tubing and plywood. Cut the four 8' pieces of the copper tubing to 6'11" with a pipe cutter, then use extra-fine steel wool to polish the copper tubing to remove oxidation and let the beauty of the copper show. To ensure that the antenna will continue to look good and resist the elements, apply several coats of a spray-on acrylic protectant to the copper tubing. Prepare the plywood with two or three coats of weatherproof paint, allowing two

days of drying time between each coat. Next week, the plywood and the tubing will be ready to go.

The first step in actual construction is to draw an X on the center board where the copper tubing arms will go. After drawing the X, measure 2.25" from dead center on each line. This is where the end of each arm is placed on the board. Place the pipe brackets over one arm and use this arm as a guide for marking holes for the bracket bolts on each line. Next, drill the holes for the brackets and a 1.25" hole at dead center for the mast. If you are using a larger or smaller mast you should adjust the center hole size accordingly.

The next step is to drill a small hole on the



Photo A. The construction team with materials. Left to right: John Williams N5SJZ, Debby Williams N5SKA, Joe Nunnamaker KD3VR.

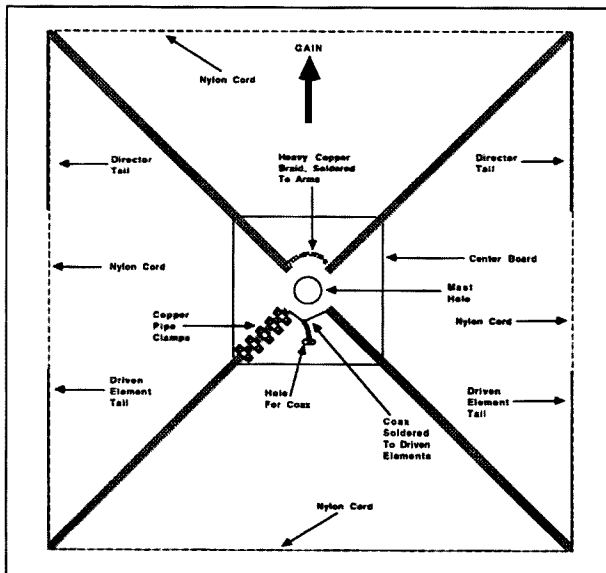


Figure 1. Top view, looking down.

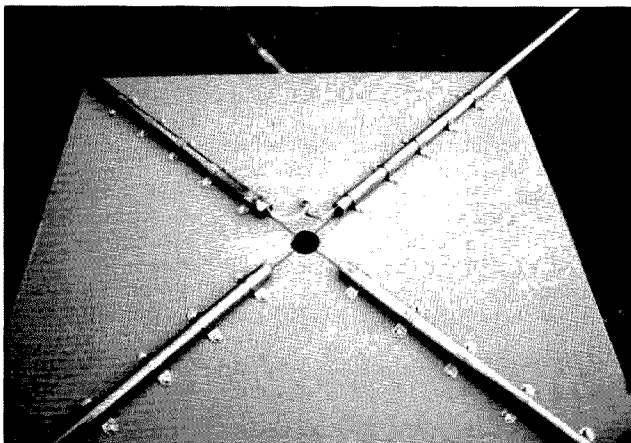


Photo B. Close-up of the coax connector soldered to the driven element arms.

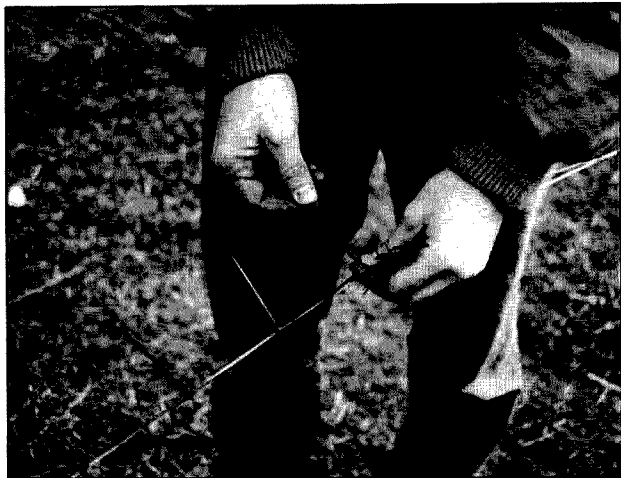


Photo C. Using plastic wire ties to secure tails to nylon supporting cord.

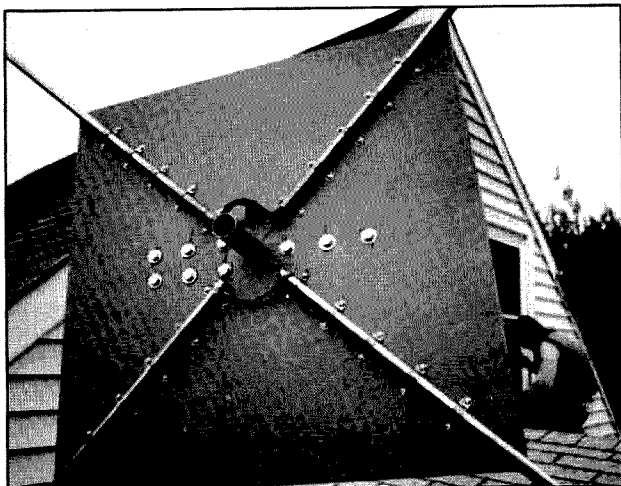


Photo D. Close-up top view of finished antenna center board.

center board between two arms. It makes no difference which two arms you choose at this point since they are all the same length. Route the pigtail coax connector (or plain coax) through the center board and solder the inner conductor to one arm and the outer braid to the other. These now become the driven arm elements. To ensure the best contact, clean the areas on the arms to be soldered with steel wool to remove the acrylic protectant previously applied. Since the weather was somewhat cold, we used a propane torch for soldering instead of a soldering iron. Since we were concerned that the paint would be blistered by the heat, we solved this potential problem by placing a double thickness of aluminum foil under the arms when soldering close to the center board. After soldering the coax connector, solder a heavy piece of copper braid to the other two arms. The arms connected with copper braid become the director arms.

Now that the driven element and director arms have been determined, it's time to solder the element tails to the ends of the arms. Since the element tails will not be under stress, we chose 16-gauge enamel-coated sol-

id copper wire instead of Copperweld wire. Start with each driven element tail 36" long and each director tail 30" long. If you use aluminum tubing or smaller gauge wire you will need to start with each element tail 12" longer to ensure that the antenna can be tuned. If using coated wire, carefully scrape away about 1" of the enamel coating at the ends of the wire to be soldered. To ensure a durable connection, bend the ends of the wires in 1", then solder them parallel to the arms.

To provide support for the element tails, use nylon cord strung through the ends of the arms. To prepare the arms for the cord drill two 1/8" holes, located 1/2" from the ends of each arm, parallel with the center board. Pass one length of nylon cord through the holes, pull it tight and tie it securely. Place the element tails beside the nylon cord and use plastic wire ties to secure them to the cord. The cord not only supports the element tails, it also strengthens the entire antenna structure.

Mounting and Finishing

Now it's time to prepare the antenna for mounting. For good strength use three L-

brackets to support the antenna. Place two brackets on one side of the center board and one opposing the other two. Start the L-brackets about 1" away from the edge of the center hole to allow for proper U-bolt placement. After marking and drilling holes, mount the L-brackets securely to the center board. After mounting the L-brackets, place the antenna mast through the center hole and secure the antenna to the mast with three U-bolts.

Now that the antenna is mounted, the next step is to form a current balun (RF choke). Form the balun by winding six turns of coax (directly below the center board) into a 6" i.d. loop. This keeps RF at the antenna and prevents stray RF from coming down the coax cable.

You are now down to the finishing touches to make the antenna last longer and perhaps perform better. Placing plastic wire ties around the coax directly above and below the coax feedhole in the center board will provide strain relief for the coax. Coax seal applied to exposed coax will keep water out and will prevent premature coax failure. Finally, to help ensure a longer life for the center board, apply touch-up paint to any small chips that resulted from drilling.



Photo E. Bottom view of center board. John making current balun (RF choke).

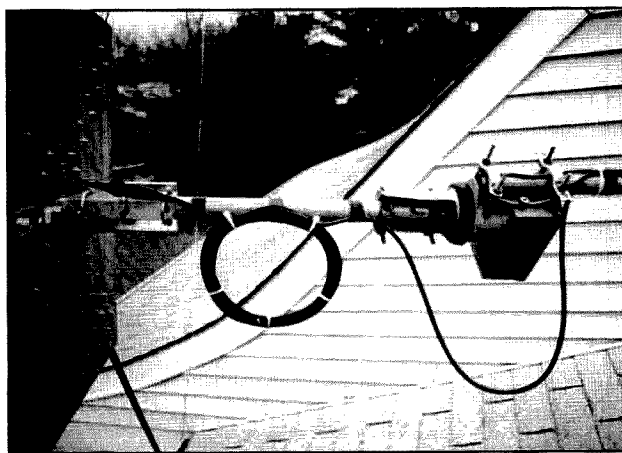


Photo F. Side view of current balun (RF choke) on antenna.

The final step before going on the air is tuning. First, remeasure each element tail. At this point the driven element tails are 36" and the director tails are 30". The driven element tails must be exactly 6" longer than the director element tails. If they are not the same, cut them to length. To tune the antenna, place it in its final position and measure the SWR. The antenna is tuned by taking the antenna down, cutting 1/4" off each tail, putting the antenna up, and remeasuring the SWR. It will most likely take several rounds of checking SWR, cutting the tails, and remeasuring SWR before the antenna is tuned. Our final measurement for each driven element tail was 34", while each director tail was 28". As shown in Table 1, the X-Beam antenna is usable from one end of 10 meters to the other! Since the tail lengths may vary according to the material used in the antenna construction, the antenna height, etc., it is much better to start with tails a bit too long and cut to size.

Performance

The X-Beam more than met my expectations. According to the *ARRL Handbook*, forward gain is about 5 to 6 dBd. Also, the angle of radiation seems very low. The first noticeable difference in performance was that we could hear many more DX stations than with the dipole.

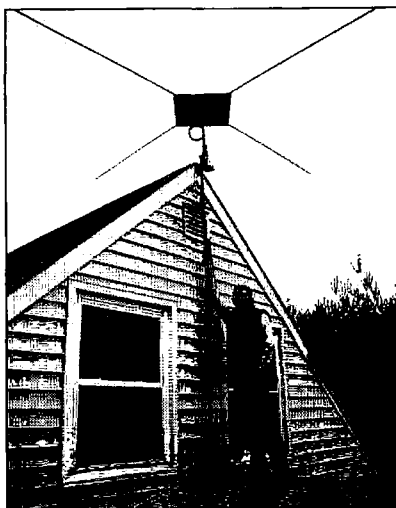


Photo G. The finished antenna.

I have gotten reports of 2 to 3 S-unit differences from both stateside and DX stations, depending on where the beam is pointed. With only 25 watts, I have been able to work pile-ups to DX stations in Senegal, New Zealand, the Balearic Islands, Denmark and Japan, to mention a few. Now I have a fighting chance in pile-ups. Put one up and you will, too.

Parts List

4	Pieces 1/2" copper tubing, cut to 6'11" each
1	2-foot-square piece plywood
1 pint	Weatherproof paint for plywood
1 can	Spray acrylic protectant for tubing
15'	16-gauge copper wire
4"	Heavy copper braid
3	Heavy L-brackets
3	U-bolts
20	1/2" pipe clamps
40	Small bolts, 1/4" x 3/8"
9	Large bolts, 3/8" x 1"
	Nylon cord
	Plastic wire ties
	Coax-seal

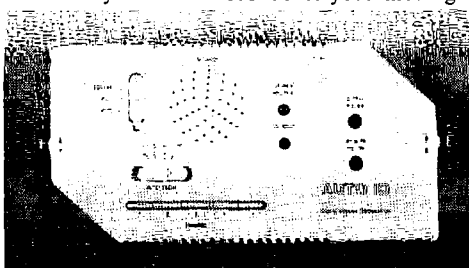
SWR Measurements

Frequency	SWR
28.0	1.6
28.1	1.5
28.2	1.4
28.3	1.4
28.4	1.3
28.5	1.3
28.6	1.3
28.7	1.3
28.8	1.3
28.9	1.2
29.0	1.2
29.1	1.2
29.2	1.2
29.3	1.3
29.4	1.3
29.5	1.3
29.6	1.4

AUTO-ID AUTOMATIC MESSAGE BROADCASTER

The **AUTO-ID** is a solid state digital voice recorder that was developed especially for 2 way radios. It simply plugs in between the radio and it's microphone. With the use of your radio microphone, you can record up to 5 separate messages that can be played on the air by pressing one of the 5 message buttons. The **AUTO-ID** also has a built-in timer that monitors your PTT (push to talk) activity. Record your station identification, and thereafter any time you are on the

air, the **AUTO-ID** will broadcast your ID message for you. The **AUTO-ID's** message #1 timer can be set for intervals of 3 or 9 minutes or it may be set to broadcast your message



every time you use your PTT. With the use of the **AUTO-ID's** built in speaker, you can monitor the message that the **AUTO-ID** is broadcasting, regardless of whether the selected message was broadcasted automatically or manually.

The **AUTO-ID** comes with plugs for an Alinco or Kenwood mobile amateur radio. There are accessories available to interface the **AUTO-ID** to most other types of radios.

FEATURES

- 12VDC power jack.
- Microphone patch cord (INCLUDED).
- 110VAC adapter (INCLUDED).
- Fully wired and tested, just plug it in.
- No soldering required.
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- Adjustable speaker volume.
- Adjustable microphone level.
- Adjustable message broadcast time. (Message "1" only)
- Connects directly in line between radio and microphone.
- Pre-wired for Alinco and Kenwood Mobile radios.
- Power, Record and Play LED indicators.
- TX ready LED indicator.
- Timer enable/disable switch.
- All solid state construction.
- Up to 5 separate messages can be played individually.
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- Simple to use.
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I'm sure you know the problem. There is some trivial soldering task to be performed . . . out in your car, up on the roof, or under the hood of your car. You spend far more time messing around with tangled extension cords than it takes to do the work itself.

Or perhaps it's worse than that: You're bicycle-mobile, halfway up Slumgullion Pass In Colorado, chatting with a mountain-topper, when he starts complaining that your signal is intermittent. You stop to look, and you see it—the kluge antenna connection you kept meaning to fix has come loose at last. Do you try to hold it together with duct tape, or pitch camp and wait for an airlift?

Sometimes it's merely irritating—you're in your shop, crawling around some piece of gear, and your coffee sails off the corner of the bench when you tug on the iron's cord in a futile quest for that extra three inches. Argh.

It's a pain to be tethered, isn't it?

The Solution

Numerous cordless soldering irons have appeared over the years, both electric and butane. As a full-time nomad, I've tried them all with generally disappointing results . . . dreading on-the-road soldering tasks until now. Last year I finally found a portable tool that is actually MORE useful than any of my conventional lab soldering stations—the Ultratorch from Master Appliance.

The company offers a number of models, but my favorite is the UT-100Si (self-igniting). Available with 16 different tips plus a heat-shrink nozzle, this 10-inch, 5.5-ounce tool will change your life. I actually carry TWO of them on my bicycle: one permanently fit-

ted with the heat-shrinker, the other with a 0.5 mm tapered-needle soldering tip. They both see heavy use in labs and on the road. Using it is a simple matter of turning on the gas at a suitable level and pushing the built-in piezoelectric igniter button. After a few seconds it's ready for work—it's that simple.

Ultratorches run on standard butane and refill easily from the canisters sold in grocery stores for cigarette lighters. The self-igniting model gets about three hours of use on its mid-range heat setting. There is also a model without the igniter (the UT-100)—this gets

less running time per tankful, but has the advantage of a 2372-degree-F torch mode (the UT-100Si will do that too, but only with its relatively fragile innards exposed . . . not recommended).

I have found the power to be quite acceptable for all the usual hardware hacking and maintenance tasks, up to and including coax connectors and PC-board ground planes (using a larger tip, of course). At the low-wattage settings the tiny tip is comfortable around delicate circuitry, and the heat shrinker will pay for the tool all by itself. Quality is excellent, and various little touches indicate that the designers paid close attention to the needs of the market—like a flat area on one side to keep it from rolling away.

Another model in the Ultratorch line is the UT-50, a pencil-length unit (6" and 2.2 oz.) complete with pocket clip. It's not self-igniting, but it has all the other features, including torch mode. Though it only gets about 20 minutes on a charge, it fits just about anywhere and is comfortable around dense packaging.

I have probably burned over a liter of butane in my two units—over 100 hours of use. I've been on my back in a campground, fixing a bicycle wiring harness connector . . . deep in a prototyping project in a Silicon Valley lab, whipping up a switching power supply . . . under the hood of a diesel truck, grafting a power cable . . . on an antenna tower, fixing a preamp . . . all with Ultratorch in hand. If you have relegated the cordless soldering irons of yesteryear to the dusty recesses of your flea-market FOR SALE box, give the Ultratorch a try. You just may end up getting rid of your AC-only bench iron instead.

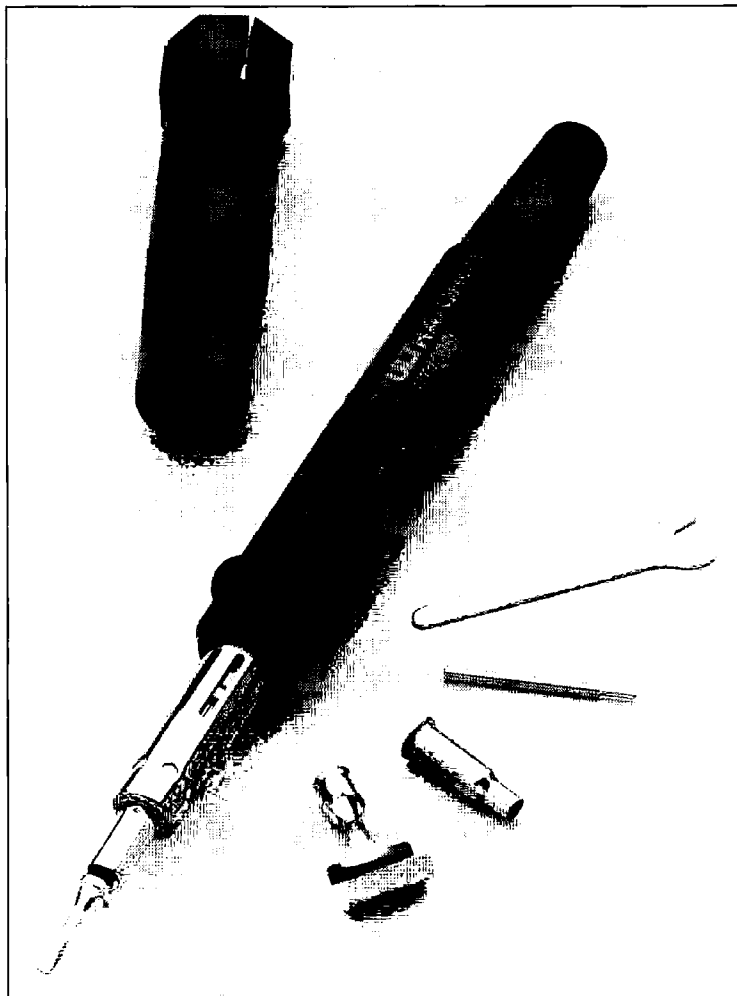


Photo A. The UT-100Si from Master Appliance.

Lightweight, Collapsible Quad for 2 Meters

Excellent performance in a small package.

by Chester S. Bowles AA1EX

New England is blessed with numerous mountains and hiking trails. While our mountains aren't large by Western standards, they are interlaced with roads and trails that make them very accessible—a perfect opportunity for VHF/UHF mountaintopping trips.

I have been a licensed ham since 1967. However, when I purchased my first HT just a few years ago I discovered the pleasure of combining amateur radio with my occasional hikes through the woods. Of course, the elevation makes long-distance contacts easy. As an example, one of my most pleasant contacts occurred during a hike along the Wapack Trail, which has a trailhead just behind my house in Sharon, New Hampshire. Using the Mt. Greylock repeater in western Massachusetts, I had a long conversation with another hiker who was on the Appalachian Trail in Vermont. As we both huffed and puffed along our respective trails, we marveled at the technology that allowed us to communicate so easily across so many miles.

But using HTs on mountaintops presents some technical difficulties. Even using low power and a rubber duck antenna, keying the mike often opened up multiple repeaters. Hearing all those IDs come back was fun, but having any sort of contact was impossible. In addition, I was disrupting communications in multiple locations. The need for a directional antenna was obvious.

I began to think about various portable antenna options. However, my experience with directional antennas is very limited, so I invested \$20 in the latest edition of the *ARRL Antenna Handbook*. It was a wise investment. The book is filled with technical information, along with numerous construction ideas. After reading the appropriate sections of the book and talking with some ham friends, my design began to take shape. Construction and tuning, however, turned out to be more difficult than I expected.

I chose to build a quad because of its inherent light weight and because (I thought) no matching would be required. Also, in theory, a two-element quad has more gain than a three-element yagi, making the boom length shorter and therefore more portable. My basic design was good. Construction was simple, the antenna collapsed as expected, and the weight was acceptably low. I quickly discovered, however, that at VHF

frequencies the ratio between wire diameter and element length is crucial. Therefore, the formula for determining the length of a quad's driven element (1005/fMHz) did not work. Countless experiments with various gauge wires and element lengths left me no closer to success. I could not get the SWR below 2.8.

As it turned out, the solution was a simple stub-matching network using a trimmer capacitor. With that addition, the antenna matched perfectly, with SWR readings of less than 1.2 across the entire 2 meter band.

Construction

Construction of the quad is simple and takes very little time. Also, the materials are easy to find and inexpensive.

Start the construction by assembling the boom. The distance between the wire elements is not crucial; any length between 15" and 16" will work just fine. The boom consists of five pieces, as shown in Figure 1. The best approach is to cut two pieces of PVC piping, each about 7" long. Then assemble the boom and measure the distance between the spreader holes. Adjust the length of the boom by cutting off short sections of PVC piping until the total length is correct. Do not glue any of the connections or the antenna will not be collapsible. The parts will stay together by friction.

Next, drill 1/4" holes completely through the boom elements as shown in Figure 1. Note that one set of holes is in the coupling while the other set is in the 3/4" piping itself. This allows the spreaders to be rotated when collapsing the antenna. Drilling holes in PVC is perhaps the most difficult part of the construction. Use a nail or other sharp object to make an appropriate starting point

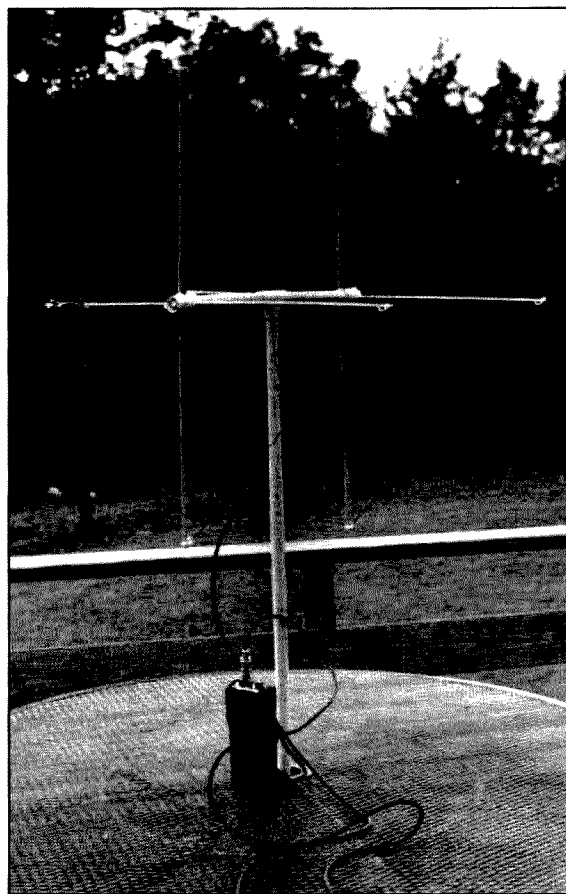


Photo A. The quad shown fully erected. Additional pieces of PVC piping can be added to the mast if more height is needed.

on the PVC. Then, drill carefully, making sure the holes are straight and perpendicular to the PVC. Otherwise, the spreaders will be crooked.

Insert the 1/4" dowels through the holes. I used nylon ties to hold the dowels in place. Do not cut the dowels yet. That will be the last construction detail.

Select one set of wooden spreaders to be used as the reflector element and, using the nylon ties, loosely secure one plastic ring to each of the four spreader ends. Then, loosely secure one plastic ring to three of the spreader ends that will be used as the driven element. The plastic ring is not required on the fourth driven element spreader because



Photo B. The quad shown fully collapsed and ready to be carried to your favorite mountaintop. Note the HT for size comparison.

the coax feed and the matching network will be installed on that spreader.

Cut the wires for the driven and reflector elements using the 18-gauge hookup wire. The driven element should be 82.5" (209.6 cm). The reflector should be 86.6" (220.0 cm).

Feed the reflector wire through the plastic rings on the reflector spreaders. Then strip about 1/4" of insulation from each end of the wire and solder the two ends together, making a complete loop. Position the plastic loops along the spreaders until you form a tight, perfect square (it helps to measure the distance along each spreader). Finally, tighten the nylon ties securely and cut the tails.

Construction of the driven element is more complex because of the matching network. First, feed the driven element wire through the three plastic rings on the driven element spreaders. Then, using a nylon tie, secure the driven element wires to the fourth spreader, as shown in Figure 2. Assembly and construction details of the matching network are also shown in Figure 2. Use caution when soldering to insure a good connection and to avoid overheating the components. Position the wire into a perfect square and tighten all the nylon ties, cutting the tails. Finally, secure the matching network and coax to the spreader using additional nylon ties.

A 30" piece of PVC piping serves as a short mast. Additional connectors and lengths of piping may be added to extend the mast if desired.

The only remaining construction detail is to trim the wooden spreader elements. Pruning shears work very well, but leave about 1/2" of extra dowel in case future adjustments are necessary.

Adjustments

Signals generated by a quad antenna are polarized. If you want vertical polarization, the antenna feed point must be on one of the horizontal spreaders. Conversely, if you want horizontal polarization, the antenna feedpoint must be on either the top or bottom spreader. The design of this quad allows the polarization to be changed easily—just twist the spreader elements 90 degrees.

Antenna matching is accomplished using an SWR bridge and tuning the trimmer capacitor to achieve the best reading.

To collapse the antenna, pull the PVC piping out of the "T" connector. Then, while holding the wooden spreader elements, twist the PVC piping and connector 90 degrees. The spreader elements will then line up in a package about 30 inches long. Of course, the wire elements will hang loosely at this point, but they will stretch back into shape when the antenna is reassembled.

I tested the antenna on several recent hikes. One hike took me up Mt. Monadnock in southern New Hampshire, and the second up Mt. Azischoos in northwest Maine. Performance was as good as expected. The antenna fit easily into a long, narrow bag that I could wear like a backpack. Assembly was easy and quick, taking less than two minutes. And, best of all, the signal reports were outstanding. Using less than 1/2 watt, I was easily able to work repeaters 60-70 miles away with full quieting. Using 3 watts yielded similar signal reports on repeaters more than 100 miles away. Simplex was fun, too. The gain and directivity allowed me to block



Photo C. Close-up showing details of the construction of the matching network.

side signals quite well and to work selected stations with ease.

A note of caution: This antenna was designed to be very lightweight and portable. As a result, it is fragile. The 1/4" dowels can easily be broken, so use care when handling the antenna. Also, the antenna was designed to be used in fair weather. The capacitor and the wooden spreaders should not be exposed to rain or moisture. A light coat of spray lacquer or silicone sealant would afford some protection. Finally, the capacitor can be bumped easily, causing the setting to change. A drop or two of clear fingernail polish will "cement" the capacitor at the proper setting.

Those cautions aside, the antenna performs extremely well and is easily carried on hikes or climbs. I'm sure it will afford much pleasure on your mountaintopping expeditions.

PARTS LIST

- 1 3/4" PVC pipe, 10 ft. long
- 2 Couplers for 3/4" PVC pipe
- 1 "T" connector for 3/4" PVC
- 4 1/4" x 36" wooden dowels (for the spreaders)
- 1 Package nylon ties
- 7 1/2" plastic rings (available at craft stores)
- 20' 18-gauge hookup wire
- 6" 300 ohm TV twin lead
- 1 Trimmer capacitor 6-50 pF (Radio Shack # 272-1340)
- Coax and connectors

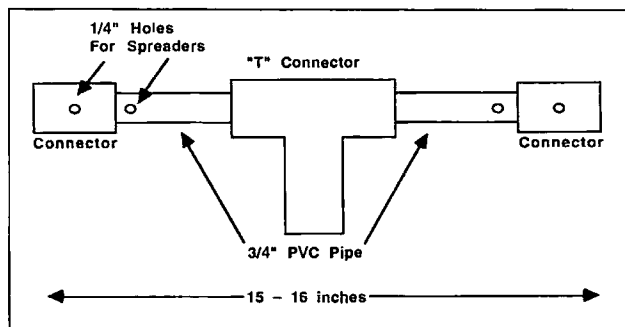


Figure 1. Boom construction.

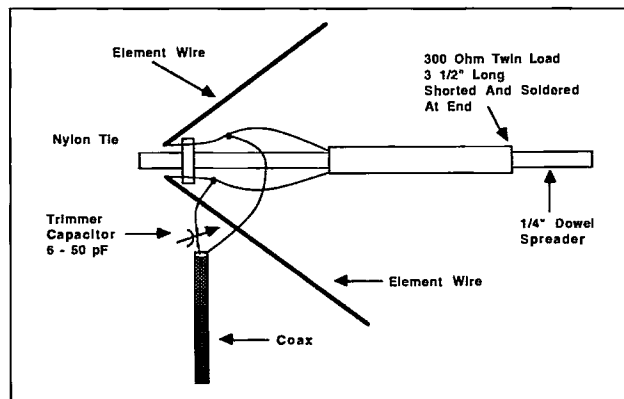


Figure 2. Detail of matching network.

Want A Dish?

Building your own is easier than you think.

by Ralph E. Herzler WA8WBP

A homemade dish does not need to be a mathematical nightmare. The literature is full of complicated formulae that supposedly tell you how to construct the dish of your dreams. You need not be a rocket scientist to cut through all of this mish-mash. Allow me to take you step-by-step through the process.

Calculations and Construction

The usual first decision in designing a dish is to establish the desired diameter. The larger the diameter, the greater the gain of a dish antenna system. Most of us are limited by physical or other constraints to a maximum diameter. In my case, the space available on the rotating bar of my satellite antenna system limited me to a four-foot dish. Since some of my QSOs involved hams using a dish of this size on the frequencies that I wanted (1269 and 2400 MHz), I was encouraged to proceed.

After you determine a suitable diameter, the next choice is the f/D ratio, where f is the focal length of the dish and D is the diameter already determined. The focal length is the distance from the deepest part of the dish to the closest end of the feed system. Feed systems may be of several kinds and are another subject. Suffice that the recommended f/D ratios for amateur work are between 0.4 and

0.6. I chose 0.5, which gave me a focal length of 24 inches.

Knowing the focal length and diameter makes it possible to determine the depth of the dish. The only formula necessary is: $d = D^2/16f$, where d is the dish depth, D is the dish diameter, and f is the focal length, all expressed in inches. Thus, my four-foot dish with a focal length of 24 inches would be $48^2/16 \times 24 = 6$ inches. that is all there is to the math!

With guidance from Bob Douglas W5GEL, I built a dish based on these dimensions and similar to the construction project by Keith Berglund WB5ZDP published in the May 1989 issue of *73 Amateur Radio Today* ("Inexpensive Mode-L Dish Antenna"). Instead of using a formula to establish the paraboloid, I simply laid out a scale on 1/2" plywood marking 1" points from zero to six in one direction and 4" points from zero to 24 (the dish radius) in the other direction. Draw lines from the zero-zero point to each of the six 1" points. By joining the intersection of these lines and the six 4" points on the other axis, the contour of half the dish was established. See Figure 1.

Sawing this contour from the marked plywood will produce an excellent bending fixture, as shown in Photo A. I chose to use aluminum channel for the ribs and found it, called "half-inch plywood channel," at a local distributor. When one end is clamped to the fixture, you can easily shape the channel to the fixture by us-

ing a rubber mallet. There is some springback to the formed piece, which I corrected by hand. If I were to do this again, I would deepen the curvature of the fixture enough to compensate for the springback. However, hand correction is accurate enough for this frequency range and below. Higher frequency operation might be a bit more fussy.

In my application, I felt it desirable to build a lighter unit than that described in Keith Berglund's article, while maintaining his excellent methods of attaching the ribs to a hub and providing means to attach the 1" and 3/4" sections of pipe for counterbalance and feed support, respectively. The counterbalance, in my case, is a 24" length of pipe coupled to the mounting flange with a pipe tee. The tee's purpose is to introduce coax and other wiring through a length of 3/4" PVC pipe and carry it to the feed device. The length of PVC pipe is such that the hot end of the feed device is at the focal point, in my case 24". Each end of the PVC pipe is threaded with an extra-long thread to provide for adjustment to the focal length. By using this method of supporting the dish feed, I was successful in avoiding additional feed supports. However, be prepared for your hardware man to doubt your sanity when you ask him to thread PVC pipe, since it is usually glued.

In a further effort to keep weight at a minimum, I cut pie-shaped sections of 1/4" mesh hardware cloth to fit the rib assembly so that the factory-finished edge forms the outer edge



Photo A. Plywood bending fixture.

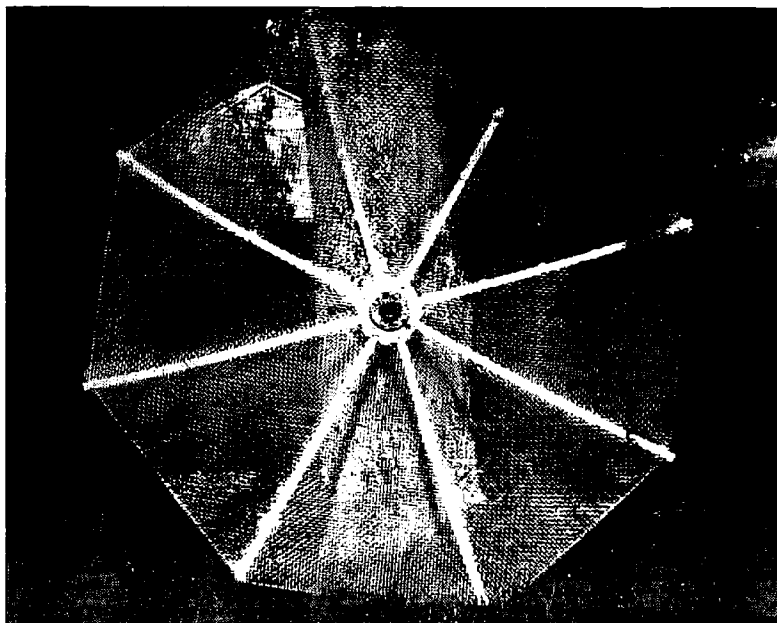


Photo B. Hardware cloth mesh attached to ribs.

of the dish. Note that these sections may be cut alternately up and down from 24" hardware cloth to minimize material usage. The sections were cut wide enough to overlap at the ribs and attached with #6 sheet metal screws and fender washers. No peripheral stiffening is necessary because the finished edge is sufficient support. This method of applying the mesh also avoids many cuts and scratches. Photo B shows the rib assembly with the mesh applied to the ribs.

The Feed System

In choosing a feed system for this dish, I was confused by the complexity of the "feed horn" approach and could not visualize how both 2.4 GHz and 1269 MHz could function in the same enclosure. The adjustment looked tricky, and having the extra coax required for matching at 2.4 GHz bothered me. Having built several helix antennas, I thought that two concentric helices might be possible. It certainly would simplify aiming, compared to mounting two separate feeds off-center but on the same backplate. In fact, because Mode S aiming is so critical, skewing the receive antenna to compensate for off-center mounting would move the 70 cm antenna completely out of alignment. The concentric approach seemed the only way to go. Boy, did that raise some questions!

Would two helices mounted concentrically interact? With the 2.4 GHz helix being very close to a second harmonic of the 1269 helix, would it pick up enough RF to destroy the 2.4 GHz GaAsFET preamp when Mode L was being used? (I have nearly 50 watts in that Mode and it would be within 3/4" of the

smaller helix.) Since I planned to run my coax and power wiring through the support pipe for the feed, would that interact with the feed system? These were questions that I could not find answers for. I could only try the system for real answers and, happily, all were favorable. No doubt I will be challenged from some corner, but the proof is that the system works.

The performance of this antenna system exceeded my most optimistic expectations. I am able to clearly hear Mode S signals that were down in the noise before, and my own signal on Mode L is much stronger than it was when I used a pair of 13-turn helix antennas. The finished dish, in place, is shown in

Photo C. The construction of the feed is quite simple, as shown in the step-by-step photos. Photo D is the 7" diameter backplate with the coax fittings in place. Two 9/16" holes, appropriately located on the periphery of the helix coils, were drilled to mount Type N connectors, and two other holes were drilled to secure the center tubing. The large hole was cut with a hole saw in a drill press; the others, simply drilled. The coax fittings were mounted with 4-40 bolts into tapped

holes. The tubing support holes were tapped for 6-32 hardware.

The center support tubing is a 6" long, 1-1/2" diameter PVC tailpiece standard plumbing fitting cut to 3-1/2" long, leaving the flange for securement. I coated the flanged end with PVC cement, inserted it in the 1-1/2" hole and secured it in place with two 6-32 bolts and washers.

The 2.4 GHz helix is three turns of #14 wire wound as a left-hand thread on the center support. I secured the lower end by carefully soldering it to the innermost type N fitting, wound it with 1" spacing between turns, and secured it at the outer end by bending it inward through a small hole drilled for that purpose. Photo E shows the helix mounted to the tubing. A small piece of brass shim stock is soldered to the coil near the backplate for impedance matching. A 3/4" PVC pipe thread to cement joint adapter is inserted in the support tubing. There is a stop in this fitting to keep the unthreaded pipe from entering the adapter too far. I removed this stop with a 1" drill and then cemented the adapter in the outer end of the 1-1/2" tubing, threaded end out. This is the support for the entire feed system. You now have a 2.4 GHz helix feed!

The 1269 MHz helix consists of two turns of 1/4" copper tubing. I wound this also as a left-hand thread, three inches inside diameter, spaced 2" between turns. One end was drilled to slip over the pin of the coax fitting and then the coil was carefully soldered in place. I used a piece of Lucite 1-1/2" i.d. and 3" o.d. to support the outer end of the 1269 helix. After drilling a small hole in the Lucite, I tied it with several turns of plastic fishing line.

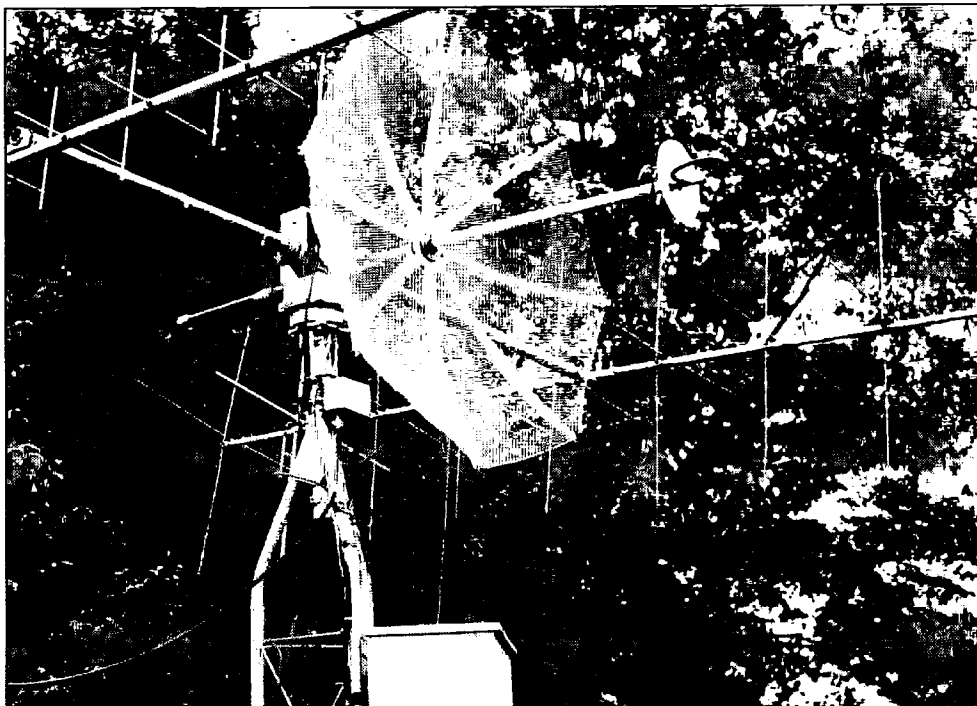


Photo C. Completed dish in place on the rotating bar.

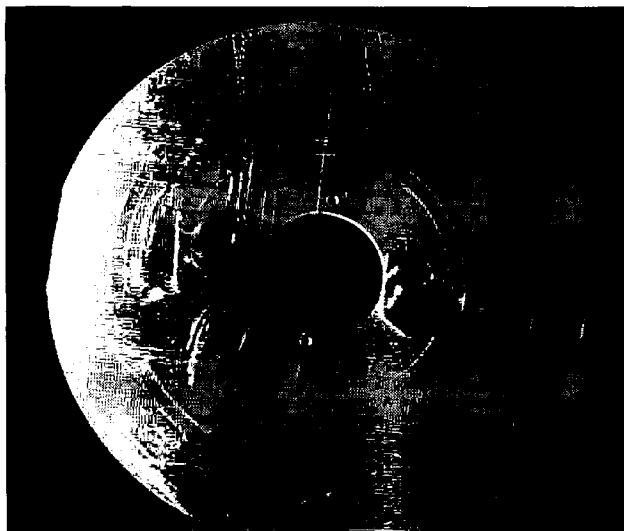


Photo D. Coax fittings in place.

Continued on page 35

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Continued from page 8

Committee asked the Digital Committee to look into the issue. A meeting was held between the Digital Committee and representatives of the HF packet community in late September 1992.

(11.) A meeting of the IARU Region 2 General Assembly (held in Curacao, Netherlands Antilles) just before the September 26th meeting between the Digital Committee and HF packet enthusiasts produced another—substantially revised—HF band plan—including segments for automatically controlled data communications.

(12.) The new IARU band plan provides segments on each amateur HF band for digital modes including RTTY, AMTOR, packet—defined as including new systems such as Clover and Pactor—but excluding facsimile and SSTV. CW would continue to be permitted throughout all amateur bands.

(13.) The League now recommends that:

(a.) Amateur stations may be operated under automatic control using any accepted protocol for data transmissions within certain small frequency segments;

(b.) Such stations should be equipped with a means to limit transmissions to no more than five minutes in the event of an equipment malfunction or interruption of contact with another station;

(c.) Third party communications may be transmitted under automatic control, using any authorized emission mode [Baudot, AMTOR, ASCII] provided that the retransmitted messages originate at a station that is being locally or remotely controlled;

(d.) HF data operation should be permitted outside those specified subbands only under local control;

(e.) The rule which prohibits automatic control while transmitting third party traffic (except packet stations using the AX.25 protocol on the 6 meter and shorter wavelength bands) should be changed so as to permit RTTY and other modes under automatic control on HF frequencies as well as at VHF and above.

The ARRL recommends the following new Part 97 wording:

Section 97.109 Station Control.

(d.) When a station is being automatically controlled, the control operator need not be at the control point. Only stations transmitting RTTY or data emissions, and stations specifically designated elsewhere in this Part, may be automatically controlled. Automatic control must cease upon modification by an EIC (Engineer-In-Charge) that the station is transmitting improperly or causing harmful interference to other stations. Automatic Control must not be resumed without prior approval of the EIC. RTTY and data stations operating under automatic control on frequencies below 50 MHz must use a digital code permitted in 97.309(a) [Baudot, AMTOR or ASCII] of these Rules, and must

incorporate provisions for discontinuing transmitter operation in the event of malfunction, or interruption of communications with another station.

(1.) Stations transmitting RTTY or data may be operated under automatic control in the 6 meter and shorter wavelength bands: 28.120-28.189 MHz; 24.925-24.930 MHz; 21.090-21.100 MHz; 18.105-18.110 MHz; 14.094-14.0995 MHz; 14.1005-14.112 MHz; 10.140-10.150 MHz; 7.100-7.105 MHz; or 3.620-3.635 MHz.

(2.) Stations authorized by these rules to transmit RTTY or data communications under automatic control may transmit third party communications. Any retransmitted messages on behalf of any third party must originate at a station that is under local or remote control. *TNX W5YI Report, Vol. 15, Issue #4, February 15, 1993.*

Newcomers Grow by Another 5% in 1992 . . . Versus a 54% Increase in 1991

The final licensing statistics are in! Nearly 75% of all first-time ham operators chose the Code-Free Technician path into amateur radio during 1992. The Novice class continues to decline with 38% less beginners choosing this route than a year ago.

The number of beginners leaped by 53.8% in 1991 due to the establishment of no-code hamming. In 1992, there was a slight increase: 4.0% (44,748 vs. 42,660). *TNX W5YI Report, Vol. 15, Issue #4, February 15, 1993.*

Canadian No-Code

The Basic No-Code ham ticket came to Canada in late 1990. It was responsible for a 5.3% growth rate that year and another 10% in 1991. 1992's figures show an increase of 20% over 1991 through the third quarter! There are now about 35,000 ham licensees in Canada. (By comparison, there are 90,000 licensed hams in California alone!) Amateur license fees in Canada were also increased to \$23 this year. *TNX W5YI Report, Vol. 15, Issue #3, February 1, 1993.*

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. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at 73 Magazine, Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one stop bit. News items that don't make it into 73 are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327.

Want A Dish?

Continued from page 32

The two helices should be tuned for minimum VSWR on their respective frequencies. This is done by bending the small brass strips closer to, or further from, the backplate, measuring as you go. The finished two frequency helix feed and the brass impedance matching strips are shown in Photo F. I am fortunate in having a Bird wattmeter and slug for the 1269 MHz frequency for this purpose. I had no equipment to adjust the 2.4 GHz helix. However, since this is a receive only frequency on OSCAR 13, it is not as critical as the 1269 adjustment.

I did not include any kind of isolation of the 2.4 GHz (SSB UEK 13) converter to protect it from the 1269 MHz RF. This was a gamble that I took after discussing it with

Gerald Rodski, SSB's US representative. Jerry thought that this unit was tuned tightly enough to exclude the 1269 RF. While I was able to get by without protection for the Mode S converter, a more conservative approach would isolate it from the Mode L helix by a suitable RF relay.

I am grateful to Bob Douglas W5GEL for his encouragement and counsel on my project and to Keith Berglund WB5ZDP, whom I have never met, for his excellent mechanical design. Other data was gathered from the *RSGB VHF/UHF Manual*, the *ARRL Handbook*, and heaven knows how many other references. I hope that this concept may encourage others.

Note: A kit of formed, and drilled parts ready for assembly is available for both the dish and the feed from *Majara Corporation*, 408 Liberty Rd., Sturgis MI 49091; (616) 651-6394.

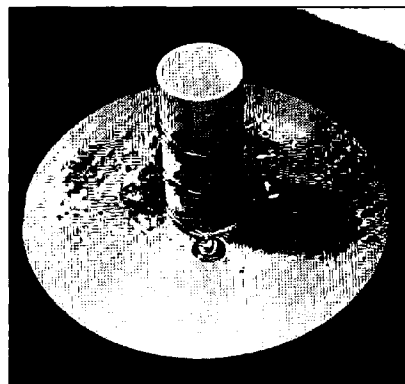


Photo E. Helix mounted to the tubing.



Photo F. Matching.

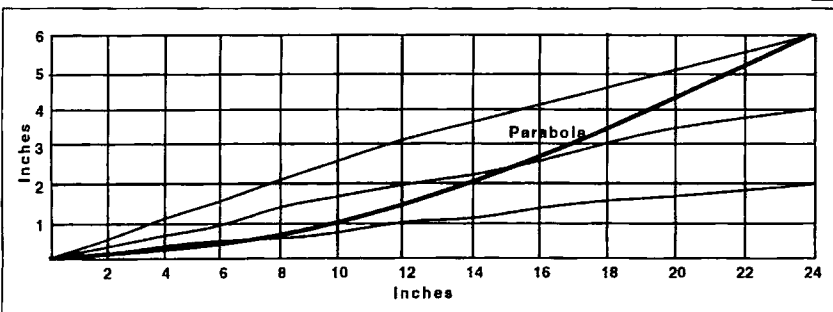



Figure 1. Parabola constructed graphically.

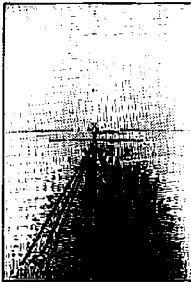


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The j•Com Zetel SDP-600 Smart Patch

Most hams, at some point in their development, dream of having an autopatch. In the old days, before there was a repeater on every hilltop, hams saved up their money to put an autopatch on the local repeater. Nowadays, hams dream of having a patch on their base at home so they *won't* have to use the local repeater. At any rate, the convenience of being able to make a call from the car, or even the drama of being able to phone in an auto accident, provide the material for a great many ham daydreams.

As with most daydreams, things go pretty well until the first "reality check." In this case, the balloon pops at the point where the hero reaches for his checkbook. Autopatches aren't cheap. The basic home-brew variety is cheap enough—but you need your own repeater to use one. Any patch smart enough to be used with a simplex base station has a big enough price tag to scare off the most imaginative daydreamers—until now.

The j•Com Zetel SDP-600 Personal Autopatch may not answer all of your dreams, but it will certainly take care of your autopatch problems—at a reasonable price. The key word here is "Personal." The SDP-600 is designed for the basic needs of the home user. It provides all of the basic autopatch functions, plus the intelligence to perform simplex sampling, for just under two hundred dollars. In addition, a few "frosting on the cake" features are thrown in as well.

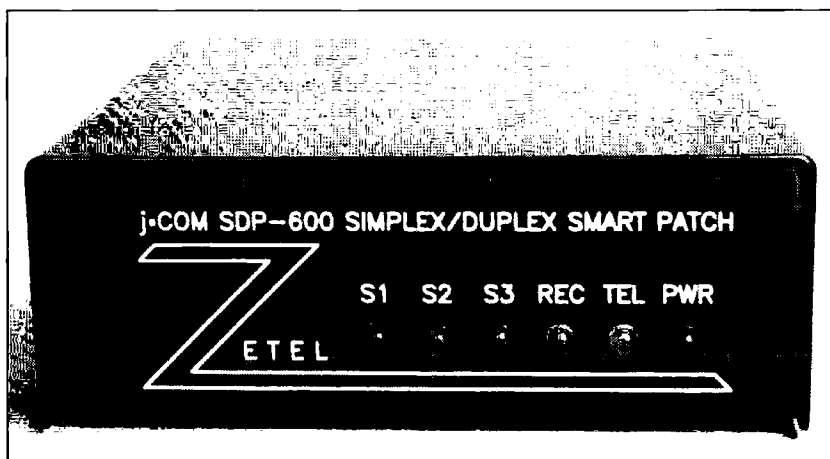
Autopatch Operation

In order to understand the operation of the SDP-600, it may help to review basic autopatch operation. As an example, an electronic phone patch has to perform the exact same functions as that stateside ham running phone patches on 20 meters for those servicemen overseas. First, the ham must establish contact with the ham on the other end. She then takes the phone off hook and dials the number. Once the situation is explained to the stateside callee, the conversation begins. During the conversation, the stateside ham must perform VOX (voice operated relay) functions. In other words, she must wait until one party is done talking, and then switch her transceiver into the other mode until the other person finishes speaking, etc., etc., etc. (On

"non-auto" patches, the parties on both end of the conversation will agree on a key word that lets the ham know when she should flip the switch. You know, something like "I love you, honey. OVER.") Once the conversation is over, she needs to hang up the phone. If she's a good operator, she'll even ID her station.

Those are the bare minimum functions required to perform a phone patch, whether on 20 meters or 2 meters. Operation of an automatic phone patch is very similar. Consider the Personal Autopatch installed on a simplex base station at our own home. Once we are within range of our house, we take the phone

In an ideal world, this type of simplex autopatch would work pretty well. In reality, some modifications to the system need to be made since we're connecting a simplex system (the radios) to a duplex system (the telephone). Simplex autopatches usually fall into two categories. The main problem to be circumvented is that of dealing with a simplex mobile and base—two radios that can't talk and listen at the same time. One way to get around this problem is called "sampling." A sampling autopatch puts the base station into transmit at the same time the phone comes off hook, transmitting the phone line audio to the mobile user. In order to tell if the mobile



The j•Com Zetel SDP-600 Smart Patch.

off the hook by dialing an access code, and the "*" sign. The SDP-600 responds with a short burst of dial tone. We dial our number, followed by another "*" The SDP-600 gives us a confirmation beep, and REDIALS the number on the telephone line. When the called party answers, their voice triggers the VOX circuit in the Autopatch, and keys up the base transmitter until they stop talking. The mobile can then key his transmitter, which allows him to talk to the called party. This VOX operation keeps up until the conversation is finished. At this point, the mobile operator dials a "#," which hangs up the phone, completing the call.

ever transmits, the patch simply "samples" the receive channel by momentarily changing from transmit to receive. This sample might occur for a quarter of a second, and repeat every two seconds or so. If the base hears the mobile during the sampling period—by detecting carrier, subaudible tone, or audio, depending on the system—it discontinues the transmit/sample mode and goes into receive. It will stay in receive, passing the mobile audio down the phone line, until the mobile's carrier drops. The base will then go back into transmit/sample, and the landline audio will be transmitted to the mobile. This is an effective system, and it keeps the mobile operator firm-

ly in control of the base station, since he can transmit a turn-off code at any sample interval—a couple of seconds at most. Unfortunately, the sampling cuts “holes” in the landline audio, making it difficult to understand under marginal conditions. In addition, the rapid transmit-receive transitions of sampling systems are best suited for newer radios without relays—and radios that don’t mind the heavier duty cycle.

The second type of simplex system is called “cross lockout VOX.” This system uses VOX circuits to key the base transmitter, based on the landline caller’s audio, and to keep the base in receive when the mobile is transmitting. As long as either party continues speaking, they will have control of the system—the other party can’t interrupt (he is effectively “locked out”). The VOX system provides for a more natural flow of conversation, and makes for more readable copy under marginal conditions. Its main drawback comes from the fact that the mobile operator has to wait until the landline caller has finished speaking before he can interrupt or send commands to disconnect the patch. This has interesting social and legal implications. As an example, this means that if your pal launches off on the five minute story of how he caught that big bass last week, forgetting that he told you the same story this morning, there isn’t a thing you can do about it until the five minute story is over. Likewise, if the person you’re talking to notices a pot boiling over on the stove and rushes off, putting the phone down next to the stereo speaker with that Andrew Dice Clay album on—well, we’re in trouble here. More likely is the problem of the mobile operator getting used to the need for the base carrier to drop before he tries to send commands to the autopatch. This means that if you transmit your phone number while the base is sending you dial tone (no big deal—I do this on the telephone all the time) the base won’t hear the DTMF tones, and you’ll get a wrong number. Once you do get the wrong number, it will probably be one of those almost endless recordings from the phone company which will keep the VOX keyed for a full minute, only dropping for a millisecond just as you’re going through heavy traffic.

As in life, the best answer is usually a compromise. The folks at jCom have produced a VOX autopatch with an intermittent sampling feature. It works as a normal VOX system, except that it samples right after the landline caller takes control of the VOX, and every 20 seconds thereafter. Each sample is preceded by a beep tone to let you know that it’s coming. In other words, you get the smooth flow of a VOX system, plus the ability to jump in and wrench control of your base station away from your foul-mouthed friends. What could be simpler?

Well, as long as you asked, duplex. In a duplex system, where both the transmitter and receiver are active in both the mobile and

the base, the mobile can send tones any time he needs to. People can interrupt and be heard. In those cases where you might not have a duplex mobile, the mode is known as half-duplex. The repeater is still duplex, and transmits the landline audio as long as the patch takes the phone off hook. The simplex mobile still pushes to talk, and listens when he’s not talking. (If you’ve made a phone patch on the local repeater using your HT, you’ve made a half-duplex patch.) With the proliferation of dual-band mobiles and bases around, personal full-duplex autopatches are becoming very realistic. This would give you the same feel as an actual cellular phone conversation—but due to the Rules and Regs, you just couldn’t talk about anything interesting or important! In any case, the SDP-600 can handle all of these modes—the limiting factor is your radio.

Extra Functions

In addition to these basic features that make for a workable phone patch, the SDP-600 has a few more functions that make life easier. DTMF tones from the mobile are received, decoded, and re-generated before be-

“If you’re looking for a well-built, full-featured basic autopatch for home or repeater use, at a price that won’t break the bank, the jCom Zetel SDP-600 could be just the ticket.”

ing passed to the phone line, in order to ensure noise-free tones at the central office. An access code of up to four digits can be used to prevent unauthorized use of the patch. A second access code can be set to allow general use of the patch, but to restrict toll calls to authorized operators. (If you’re the trusting type, these codes can be programmed out—that is, the unit will work the same as our basic patch described above.) A reverse patch function allows the patch to pick up the line when the phone rings, and send a ring tone out to the mobile. A CW ID function lets the user program in his callsign, which will then be transmitted at the beginning and end of each conversation. Timeout features are incorporated as well. If you drive out of range of your base station, the Personal Autopatch will disconnect after 30 seconds of no activity. A feature with a lot of potential is the “control output.” This is simply an open collector transistor that is brought out to the rear connector. It’s activated with an Access Code + “1” command from the mobile. This output can be hooked up to a relay, which can then control anything you desire. You might want to use it to enable or disable another radio at the site, or to reset that troublesome TNC. Less serious types will want to turn on the yard light before they pull into the driveway, or turn on the coffee maker when they’re five miles from home.

Hook up and installation of the Personal Au-

topatch is very straightforward. It’s designed to use the mike connector levels of the average rig—mike level audio out, and speaker level audio in. (This means there’s no need to dig through the radio to find detector audio.) Ground and PTT are also needed. There are four potentiometers in the unit to adjust in the event of unusual phone or radio levels, but these are pre-set at the factory for average levels. (The review unit worked fine right out of the box, even considering the lousy phone system here in the New Hampshire boon-docks.) The hardest part of the whole installation will be soldering the four-conductor interconnect cable without burning your fingers.

Wish List

The only drawbacks I found with the SDP-600 were of the “wish list” variety, not actual problems. For instance, the LEDs on the front panel indicate radio audio, phone line audio, power, and three status points, labeled S1, S2, and S3. These three status LEDs change configuration as the patch performs various functions, but it’s difficult to intuit what the various combinations mean. Examples are given in the manual, but a series of more meaningful indicators (OFF-HOOK, ACCESS CODE RECEIVED, PROGRAMMING MODE) would be very helpful, especially during installation and troubleshooting. There is no battery backup in the unit, so any parameter programming is lost in the event of a power failure. The unit does revert to a usable set of parameters, including the firmware-based main access code, but a small back-up battery or a non-volatile memory arrangement would be a nice feature. (I know, I know—I want Cadillac features at a Chevy price—but it doesn’t hurt to ask!) [Ed. Note: Beginning March 1, 1993, jCom will be shipping units which include a non-volatile memory. In the event of a power failure or when not using the unit for long periods of time, these units will retain the codes entered. Customers who purchased the original units should contact jCom if they wish to have the upgrade added to their existing units. The cost of upgrading has not been determined at this time, but is expected to be under \$40. No change in the price of the phone patch is expected.]

In the event of a problem that the manual can’t answer, the technicians at jCom are both competent and friendly. My question concerning receiver carrier detect was answered quite promptly. If worse comes to worse, the unit is covered by a 90-day parts and labor guarantee, and a 30-day money-back-if-not-satisfied guarantee.

The jCom Personal Autopatch doesn’t do two-tone paging, doesn’t have a voice mailbox system, and won’t do multiple RF link control. It also doesn’t cost two thousand bucks. If you’re looking for a well-built, full-featured basic autopatch for home or repeater use, at a price that won’t break the bank, the jCom Zetel SDP-600 could be just the ticket.

UPDATES

Active Antenna Using a MOSFET

Refer to the above article on page 32 of the March 1993 issue. While the parts placement diagram is correct, we printed the PC board pattern in reverse. The correct PC board pattern is shown in Figure 1.

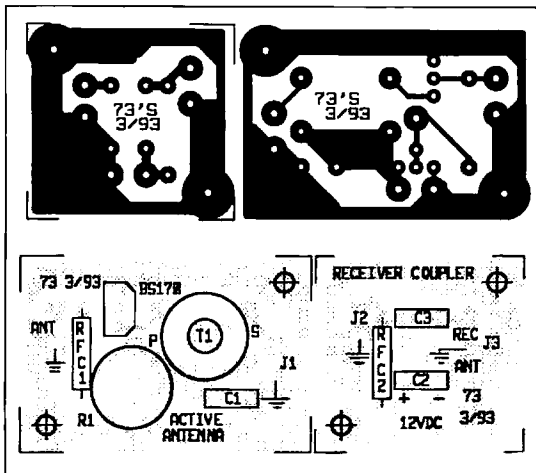


Figure 1. Corrected parts placement diagram for the Active Antenna.

Computer Control for the Ramsey FTR-146

Refer to the above article on page 60 of the March 1993 issue. Same deal as above, folks. We printed the PC board pattern backwards. The correct, right-side-up pattern is shown in Figure 2.

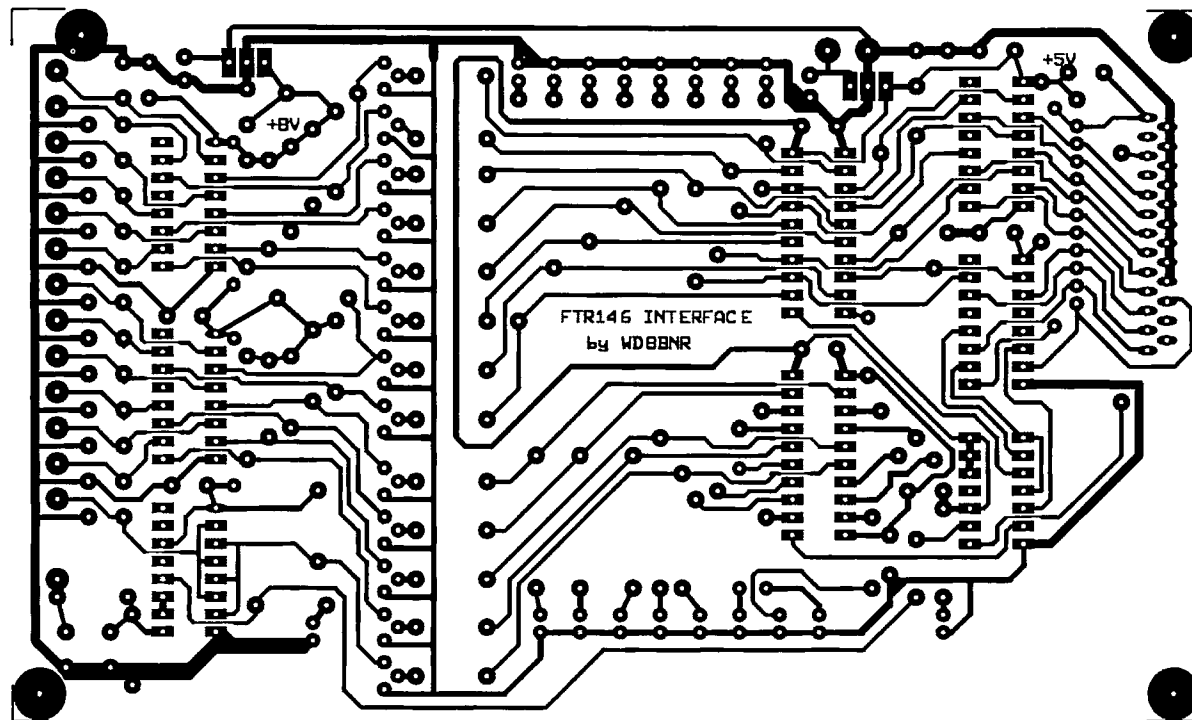


Figure 2. Corrected parts placement diagram for "Computer Control for the Ramsey FTR-146."

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Quiet Down Your Shack, Part 1

Answers to the survey that first appeared in this column a few months ago continue to come in, but one thing is already clear: Two answers top the list of problems encountered by hams. The first one—and the subject of this column—is RFI (Radio Frequency Interference) caused by all the computerized equipment that we put in our shacks today. For help with the second most common reply, "not enough money to buy gear," see "Never Say Die" in this and previous issues of 73.

How Many Transmitters?

When you count the transmitters in your shack, do you stop at the radios? Well, even if they are not supposed to, computers and their associated peripherals can put out a pretty good signal. Sometimes there is nothing you can do about the interference. Usually, a few simple techniques will greatly reduce—if not eliminate—the noise.

Before we try to get rid of it, let's take a look at where the noise comes from. Microprocessors are used in just about all consumer electronics today. They control your VCR, clock radio, microwave oven, and even some telephones. Microprocessors are sequential devices—they perform one very simple step after another. They are driven along the way by a "clock." The job of the clock is to regulate the stepping of the processor. This clock is usually a crystal oscillator, a lot like the circuit used in a rockbound rig. One difference, though, is the output waveform. While in radio design we strive for a clean sine-wave output from an oscillator, processor clock circuits are designed for square-wave output. This is a requirement; you can think of each clock pulse as the throwing of a switch. The processor and its support circuitry want nice, snappy switch throwing with definite "on" and "off" states. The sine wave just doesn't fit the bill.

From the RFI point of view, only a sawtooth wave could be a worse choice. The square wave has lots of harmonics. This means that not only does a square-wave generator produce a signal at the intended frequency, but at odd multiples of it as well. These signals can be big. For example, the third harmonic of a square wave is about a third of the power of the fundamental frequency. The fifth is .200, the seventh .143, and it goes on like that. This may not sound like a lot of power, but remember two things: The first is the inverse square

law. This says that the signal strength from any source decreases at a rate equal to the square of the distance you are from it. Your computers are in your shack—pretty close, huh?

As computers have become more advanced, their clock rates have gone up. While five years ago a fast machine had a clock rate of 10 MHz, today's fast machine runs at 50. I know from your survey responses that many of you are running 33 MHz machines in your shack. On the other hand, it is often an older machine that is pressed into amateur service. These machines, with their slower clocks, can be a real annoyance to the HF aficionado. The clocks in these machines range from about 4 to 8 MHz, with 6 MHz very common, thanks to the original IBM AT design. You can see that the harmonic products of these machines fall in various places in the HF bands. The oscilla-

"No machine is completely quiet, and they all have certain peak output frequencies, but the receiver will tell you if the noisy spots are where you need quiet."

tors in computers are always run at twice the desired clock rate and then divided by two. This means that a 6 MHz machine has a 12 MHz oscillator.

Other devices that use microprocessors can often be more troublesome than the computer itself. This is because these devices use slower clocks—1 or 2 MHz—which make even more noise at HF frequencies. VHF and UHF users are not immune to this problem, though. For example, when I first purchased my Heath HK-21 "Pocket Packet" TNC, the oscillator in it put out a full quieting signal into the handheld to which it was connected at the incredibly inconvenient frequency of 145.010 MHz. You will recognize this as the primary packet frequency for the US.

What to Do?

Now that you have some idea of the principal culprit in this situation, let's take a look at some steps to clear it up. Keep in mind that your first defense is good station practice. Sometimes the only solution is to buy better equipment of one sort or another, but according to the survey results, this isn't a solution for many of you.

Pay the Price

The FCC has requirements that cover microcomputers and their garbage that they generate. If you

have a machine that you purchased for home use, it must be certified under part 15 regulations for radio emissions. This will be the case if you purchase an IBM, Packard Bell, Gateway 2000, Apple . . . you get the idea. This may not be the case (probably isn't) if you purchase a clone machine from a local builder. Even though these machines should be certified, they are most often not. This doesn't mean that all local clone shops build noisy machines. The lack of certification is usually due to the lack of financial resources—lots of money!—needed to get certification. The upshot is this: If you are looking to buy a machine, consider paying more for a machine you know will be quiet. If you plan on buying from a clone dealer, spring for the better case—this will provide better shielding. Bring a portable receiver with you (one that operates where you plan to) and check the machine out. No machine is completely quiet, and they all have certain peak output frequencies, but the receiver will tell you if the noisy spots are where you need quiet.

Another place that paying extra

Ground That Station!

Okay, everyone with a good station ground raise your hand. What, YOU don't have a good ground? There are lots of reasons to get a good RF ground in your shack. What is a good ground? Well first, a good ground is NOT the third pin on your electrical outlet. A good RF ground must be a low inductance path at the frequency of interest. Just because a ground connection has DC continuity doesn't mean you have a good ground for your radios. A bad ground can be worse than none, since it will work as an antenna rather than a path for unwanted energy.

So what is a good RF ground? You will hear many opinions on grounding practice, but here are the basics. First, you must have a good earth ground to use. This can be accomplished with three eight-foot ground rods about three feet apart. This may seem like a lot of work, and it can be, but it will insure a low inductance connection to the earth. If you can't do this—because of bedrock, cost, or 'cause you're lazy—get as close as possible. A single four-footer is better than nothing at all. Radio Shack carries decent ground rods in both lengths. Once you have a place to connect, you need to make the connection with the shortest possible piece of cable that will provide a low inductance path.

OK, let's step back for a second. That is the third time I mentioned "low inductance." What does this mean? Inductance is a kind of "electromagnetic inertia." It is the property of an electronic component (in our case a piece of cable) that opposes changes in current. Instead of the current flowing through the component, it is stored in a magnetic field around the component. The inductance of a component is related to the frequency of the energy trying to pass through it. A single wire will have a relatively high inductance at any frequency we are interested in, which is why we use a cable.

The particular type of cable usually used for ground connections is known as "bonding cable." It looks like a heavy-duty version of the shield from a piece of RG-8U coaxial cable. This cable is composed of many smaller conductors woven together. This provides the low inductance connection we want. You can usually find a spool of bonding cable at a reasonable price by searching the tables at hamfests. If you must purchase it from a normal supplier, make sure your wallet is full—this stuff isn't cheap.

Keep It Short!

The longer the distance to the grounding rods, the less effective your ground will be. Ideally, you should locate your shack either in the basement or on the first floor, where the trip to the ground rods is short. This is not always practical, though. Those of you who must run your

buys something is in the cables that run from the computer to its peripherals. Cheaper cables often have poor shielding, which makes them into radiators of all sorts of junk. Though we have been discussing the microprocessor's clock, there are others on the peripheral controllers that connect to those cables, just waiting to QRM your favorite frequency.

What is Shielding?

We all know about shielded cable and that it is resistant to interference, but how does it work? The principle behind shielding is the same as for a Faraday cage, named for British scientist Michael Faraday (1791-1867), who discovered that if he constructed a cage of conductive material and grounded it—in England they "earth" it—there would be no electromagnetic fields inside the cage. Today, classic Faraday cages made of copper screen are used in applications like EMP (Electro-Magnetic Pulse)-proof rooms, laboratories with instruments sensitive to EMF, and the like.

In the case of cables, computers, and radios, the shielded jackets and cases keep out the noise. But, note the requirement to *ground* the Faraday cage. The cage works by providing a low inductance path to ground. Radio signals striking the cage are basically "sucked" into the ground so they can't get past the screen (another British term).

Continued on page 43

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041

Using and Stabilizing Varactor Diodes

Have you tried to buy an air variable capacitor for a receiver project recently? They are very rare these days. I've seen them advertised in British electronics catalogs, and in antique radio supplies catalogs in the USA, but otherwise it's catch as catch can. So, what to do? Well, it seems that commercial radio manufacturers today use voltage variable capacitance diodes, commonly called varactors, for the tuning function. These special semiconductor diodes exhibit a capacitance across the PN junction that is a function of the reverse bias potential (see Figure 1).

The diode representations shown in Figures 1a and 1b are in the form of PN junction diode block diagrams. In the N-type region negative charge carriers (electrons) predominate, while in the P-type region positive charge carriers (holes) predominate. When a reverse bias potential is applied, as in Figure 1a, the charge carriers are pulled away from the junction region to form a depletion zone that is depleted of charge carriers (hence acts like an insulator or "dielectric"). The situation is the same as in a charged capacitor: an insulator

separating two electrically conductive regions. Thus, a capacitance is formed across the junction that is a function of the width of the depletion zone. And because the size of the depletion zone is a function of applied voltage (compare Figures 1a and 1b), the capacitance of the junction is also a function of applied voltage. A varactor is a diode in which this function is enhanced and stabilized.

Figures 2a and 2b show two common circuit symbols for a varactor diode. In both cases, the normal diode "arrow" symbol is somehow combined with a pair of parallel lines representing a capacitor. In some cases, I've seen a variant on Figure 2a in which an arrow is drawn through the parallel plates by extending one side of the arrow symbol. I suppose that's used to indicate the property of "variableness."

Several different varactors are listed in Table 1. Several of these are also easily available in the ECG and NTE replacement transistor lines sold by parts houses that normally deal with radio-TV repair shops. Look up the specs for NTE-611 to NTE-618, or ECG-611 to ECG-618 to see if they are appropriate for your application. Alternatively, look up the replacements for those diodes in the table from the ECG or NTE crossover directories.

Varactor Tuning Circuits

The varactor diode wants to see a voltage that is proportional to the desired capacitance. Several different circuits are used to provide this function, some of which are shown in Figures 3 and 4. In all cases, the tuning voltage must be supplied from a reference voltage source that is very stable. It is normally considered good engineering practice to provide +Vref from a separate voltage regulator that serves only the varactor, even when the maximum value of the voltage is the same as the rest of the circuit (e.g. +12 volts). Therefore, always use a voltage regulator to provide the tuning voltage source potential. Most varactors use a maximum voltage around +30 to +40 volts, while many intended for car radio applications are rated only to +12 or +18 volts (check!).

The simplest and probably most popular circuit is shown in Figure 3a. In

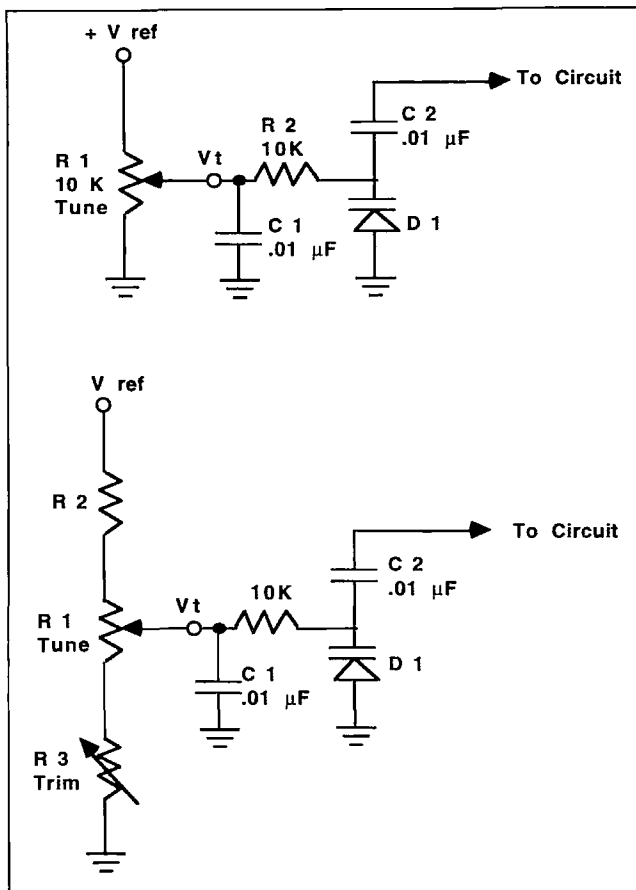


Figure 3. Varactor diode tuning voltage circuits.

this circuit, a potentiometer (R1) is connected across the Vref supply, so the tuning voltage (Vt) is a function of the potentiometer wiper position. In many cases, a 0.001 μ F to 0.01 μ F capacitor is connected from the wiper of the potentiometer to ground in order to snuff any noise pulses so they don't alter the tuning (they are, as far as the diode is concerned, valid tuning voltage signals!). A series current-limiting resistor (R1), usually of a value between 4.7k ohms and 100k ohms, is used to protect the diode in case the voltage gets to the breakdown point, and also to isolate its capacitance from the tuning circuit (otherwise, C1 would always predominate). In many cases, a DC blocking capacitor (C2) is needed to prevent the tuning voltage from affecting following circuits, or other circuit voltages from affecting the varactor diode tuning voltage. From the point in Figure 3a marked "To Circuit," the varactor network acts like a variable capacitor.

A variant circuit is shown in Figure 3b. In this circuit the tuning voltage is only a small portion of the reference voltage. Thus, the tuning voltage is produced by a voltage divider made up of three resistors: R1, R2 and R3. In

some cases, one or more of the other resistors will be a trimmer potentiometer to set the "fine" or "vernier" frequency of the overall circuit.

Regardless of which tuning circuit is used, the resistors, including the potentiometer, should be low temperature coefficient types in order to reduce thermal drift. Ordinary carbon composition resistors are probably not suitable for most applications.

If you wish to sweep a band of frequencies, i.e. in a sweep generator or swept receiver (e.g. panadapter or spectrum analyzer), then replace the +Vref potential with a sawtooth waveform. The sawtooth waveform is a linear ramp that rises to a specified maximum voltage, and then drops back to zero abruptly. Unfortunately, it is rarely the case that the sawtooth voltage range, the desired swept fre-

Continued on page 44

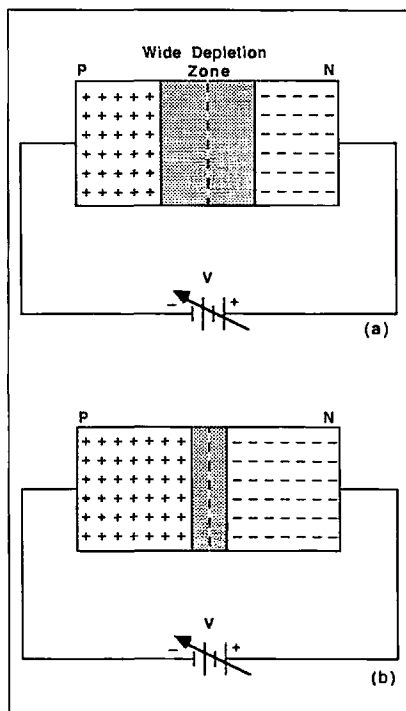


Figure 1. Varactor diode under two different reverse bias conditions.

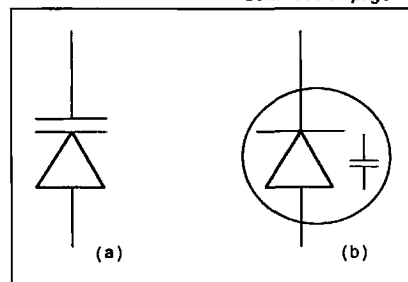


Figure 2. Varactor diode symbols.

PACKET & COMPUTERS

Continued from page 40

ground connection from the second floor might try using copper water pipe, which will have lower inductance than any wire and be cheaper than bonding cable. By the way, copper pipe makes an excellent substitute for ground rods if you have some lying around.

So you've got your good earth connection, and you've got your short run to your shack, now what? The next component that you need is a ground buss. The ideal grounding buss is a flat piece of copper with copper screws for connection to it. The point of the ground buss is to accomplish what is called a "star ground." In this scheme, all ground connections are made to a single grounding point which is itself connected to the earth. DO NOT "daisy chain" the ground connections from one piece of equipment to another. This just provides a path for ground loops and other signal messiness. The star ground is clean because the path of least resistance for RF and offensive signals is to the earth and NOT to other equipment. The reason we use copper is for low resistance. It is traditional and probably best; however, if you must use something else because of cost or availability, it will still work.

Now you've got a place to connect all of your equipment to ground. Your radios will have a ground screw, no problem there, but what about the computers? Most computers expect to be grounded through the three-pin AC connection, but as I said before, this is probably not a good ground for RF. Next month we'll take a look at grounding the computer equipment, and other steps you can take to reduce RFI in your shack. In the meantime, put in the grounding system. Not only will you get advantages when you ground your RFI-generating equipment, you'll also see great improvements in the performance of your radios with the new ground.

How to Contact Me

In addition to the address at the top of the column, you can use one of these electronic addresses to write to me:

jsloman@bix.com

This address is good for anything: questions, answers, business or fun.

N1EWO@N0ARY.#NOCAL.CA.U.S.A.NA

This address is for fun only; no business, please.

I look forward to hearing from you about this column or any other topic of interest. Please let me know what you would like to read about, and any other comments that you have. 73 de N1EWO

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CARR'S CORNER

Continued from page 42

quency range, and the varactor voltage characteristic are in sync with each other. For those situations we need to be able to provide a sawtooth of variable amplitude to set the sweep width and a DC offset tuning voltage to provide the center frequency function. Figure 4 shows how this might be done.

The circuit shown in Figure 4 uses three operational amplifiers to provide the combination tuning voltage. Op amp A1 provides a variable amplitude sweep width control to change the sawtooth amplitude. If feedback resistor R5 is made 10k ohms, then the output sawtooth will have the same amplitude as the input sawtooth. If higher or lower amplitude is needed, then adjust the gain of A1 by selecting a different R5 value: Gain = $-R5/R6 = -R5/10k$ ohms (the "-" indicates that the circuit is an inverter). For tuning voltages to 18 volts, ordinary 741s can be used for A1 through A3.

Digital frequency control can be accomplished by supplying the reference voltage (+Vref) from a digital-to-analog converter (DAC) that has a voltage output. The binary number applied to the DAC binary inputs will set the tuning voltage, which in turn sets the capacitance of the diode. Those who wish to experiment with low cost components will find that the eight-bit National DAC0800 series devices (available in most local parts stores in the Jameco Jim-Pak display) will provide 256 different steps of voltage (hence also of capacitance and frequency). An op amp is recommended to convert the current output of the DAC080x to a voltage (the national Linear Data Book gives example circuits as well as specs for the different devices in the series).

Temperature Compensation

There is one nasty little problem with the varactor tuning circuit—the thermal drift can be horrible! According to one source, the temperature coefficient of capacitance (ppm/°C) varied from about 30 ppm/°C at +Vref = 30 volts to 587 ppm/°C at +Vref = 1 volt. Ouch! There are three approaches to this problem: ignore it; use Figure 5 or Figure 6.

The circuit shown in Figure 5 uses a fixed, regulated voltage for +Vref,

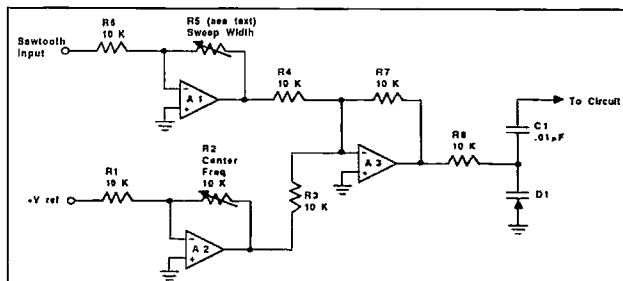


Figure 4. Sawtooth/center frequency combiner circuit.

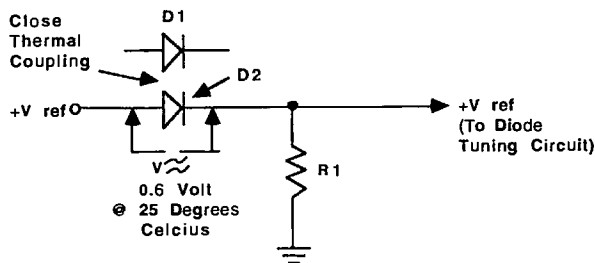


Figure 5. Simple diode thermal compensation circuit.

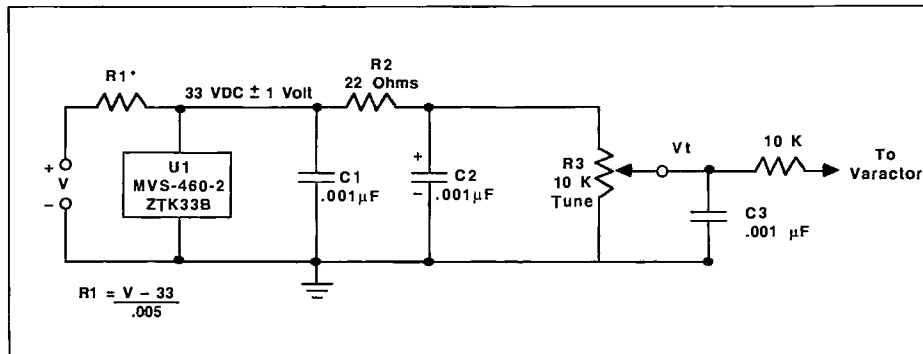


Figure 6. Using a special varactor thermal regulator IC device.

but passes it through an ordinary silicon diode (D2) that is in close thermal proximity to the varactor diode (so they see the same temperature environment). When resistor R1 is set to draw a current through D2 sufficient to get the voltage drop into the 0.6 volt region, then the output voltage

appears to be a +33 volt zener diode that has a -2.3 mV/°C temperature coefficient. It will provide a nominal +33 volt output for all input voltages (V) greater than 34 VDC. Again, the temperature stabilizer (which looks like a diode) is placed in close thermal proximity to the varactor diode

"Digital frequency control can be accomplished by supplying the reference voltage (+Vref) from a digital-to-analog converter (DAC) that has a voltage output."

+Vref will track the thermal changes to counteract the change of capacitance. In practice, R1 can be the tuning potentiometer when diodes such as 1N4148 or 1N914 are used.

Figure 6 shows a circuit using a special zener diode voltage regulator sold in Europe under both MVS-460-2 and ZTK33B type numbers. It ap-

pears to be a +33 volt zener diode that has a -2.3 mV/°C temperature coefficient. It will provide a nominal +33 volt output for all input voltages (V) greater than 34 VDC. Again, the temperature stabilizer (which looks like a diode) is placed in close thermal proximity to the varactor diode

being protected. The MVS-460-2 part is in a TO-92-like plastic package, while the ZTK33B is in the normal glass diode package (similar to 1N60 devices). Unfortunately, the MVS-460-2 and ZTK33B are hard to find in the USA. I bought some from Maplins Professional Supplies in England (P.O. Box 777, Rayleigh, Essex, SS6 8LU, England) for £0.382 each (as of this writing £1 = \$1.57, but the rate changes daily so check before sending money orders denominated in pounds sterling) in lots of 25 or more. Unfortunately, with a minimum practical order

of several pounds sterling, plus a shipping charge of £8 for USA and Canada, it is best to order 25 or so. This translates to \$27.38 or so, if the price still holds as of publication date. Ordering from the UK is reasonably easy. You can get an international money order denominated in pounds sterling at many banks, but the fee might make you puke (my bank gets \$15, which is why I opened a UK checking account). Alternatively, they will accept Visa, MasterCard or American Express cards. The bank card company will make the currency conversion for you, and they use the rate in effect on the day they make the conversion. I've used all three types of cards to make purchases from UK electronic and old book dealers (my other passion), and have experienced no problems. Give them the card number, expiration date and your signature authorizing the charge.

Well, that's that for varactors. If you want to know more theoretical smoke about the subject, then I recommend Motorola Semiconductor's application note AN847 "Tuning Diode Design Techniques" (Motorola Technical Literature Distribution Center, POB 20912, Phoenix, AZ 85036).

Table 1.

Type No.	Capacitance Range	Tuning Ratio	Frequency Ratio
1N5139	6.8 - 47 pF	2.7 - 3.4	1.6 - 1.8
MV2101	6.8 - 100 pF	1.6 - 3.3	1.6 - 1.8
MMBV105G	120 - 550 pF	10 - 14	3.2 - 3.7
MV209	30 pF	5 - 6.5	2.2 - 2.5

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

The Two-Fer

Mr. Webster describes a "classic" as being excellent; established; a standard; a model of its kind. This month we'll take a break from the charge controller to work on a simple spring classic: the Two-Fer. Yes, it was around for a while and it's been through several changes since its conception in the *QRP Quarterly*. The original Two-Fer came from Mike Michaels W3TS and John Collins KN1H. I had my hand in the first prototype PC boards and produced the first Two-Fer kits for Dayton. The kits sold out in a matter of minutes.

Several different versions have appeared in many articles. This is a modification of a modification, so to speak. Bryon Weaver WU2J did the modifying this time around. He changed out the FET used for the VXO and instead installed a common transistor. Notice that the output transistor has also been changed from the 2N3553 to an MRF476. This is a 5 watt RF transistor in the flat pak style.

The circuit will produce 2 watts out on 14 MHz with 13 volts VCC.

New Keying Circuit

This time I changed the keying circuit around. Connecting the jumper to either the "A" or "B" connection on the PC board will determine how the oscillator will be keyed.

With the original Two-Fer, the oscillator ran all the time. The oscillator supplied the matching direct conversion receiver with the needed injection for the balanced mixer. The matching receiver for the Two-Fer was a real dog. Most builders of the Two-Fer simply did not build the receiver. Therefore, you had to remove the VCC from the crystal oscillator so you could hear the other station. Otherwise, the crystal's frequency would be heard in your receiver.

With this version of the Two-Fer, you can select how you want to run the crystal oscillator: continuous or keyed. The output of the VXO may be coupled to a direct conversion receiver by a small-value capacitor. Unless you are planning on using the oscillator to drive a direct conversion receiver mixer (as in the original version),

then use the keyed oscillator configuration. This way you won't have to do any fancy VCC switching when going from transmit to receive.

A capacitor for coupling RF to a receiver mixer may be mounted on the PC board. If you don't plan on using this feature you may leave the capacitor out. But, by installing it, you have a handy place to pick up the output from the VXO. I use a frequency counter for that digital readout feeling everyone is so used to.

"QRP" column to mute the receiver and control the antenna relay if you wish. The choice is up to you.

Construction is quick and easy with the PC board from FAR circuits. Of course, you could use just about any other method to build the circuit, including perf-board. The so called "ugly" construction would work fine, too.

Notice the use of a ferrite bead on the base lead of the transistor. This improves stability in the PA under certain conditions. In some models, I had

"Construction is quick and easy with the PC board from FAR circuits. Of course, you could use just about any other method to build the circuit, including perf-board."

If you have a sluggish crystal and keying the oscillator causes chirp, then simply configure the oscillator to run continuously. Of course, you'll need to remove the VCC during receive, but you won't be chirping CW anymore either!

Solid-State QSK

This version also has something new: a solid-state QSK system. By adding a small handful of parts we end up with a no-relay QSK. Best of all, you don't have to include this feature if you don't want to! You can use the T/R controller shown in an earlier

no problem with the PA stages running away without the bead; using other transistors required installing the bead. In either case, mount the transistor as close to the board as possible.

Most of the parts can be picked up from your local Radio Shack. You should be able to build this transmitter for less than \$20, even if you buy all the parts new. If you have a well-stuffed junk box, your total cost may be next to nothing. A junk box CB would be a good source for the final PA transistor and driver. In fact, I've used several different types of transis-

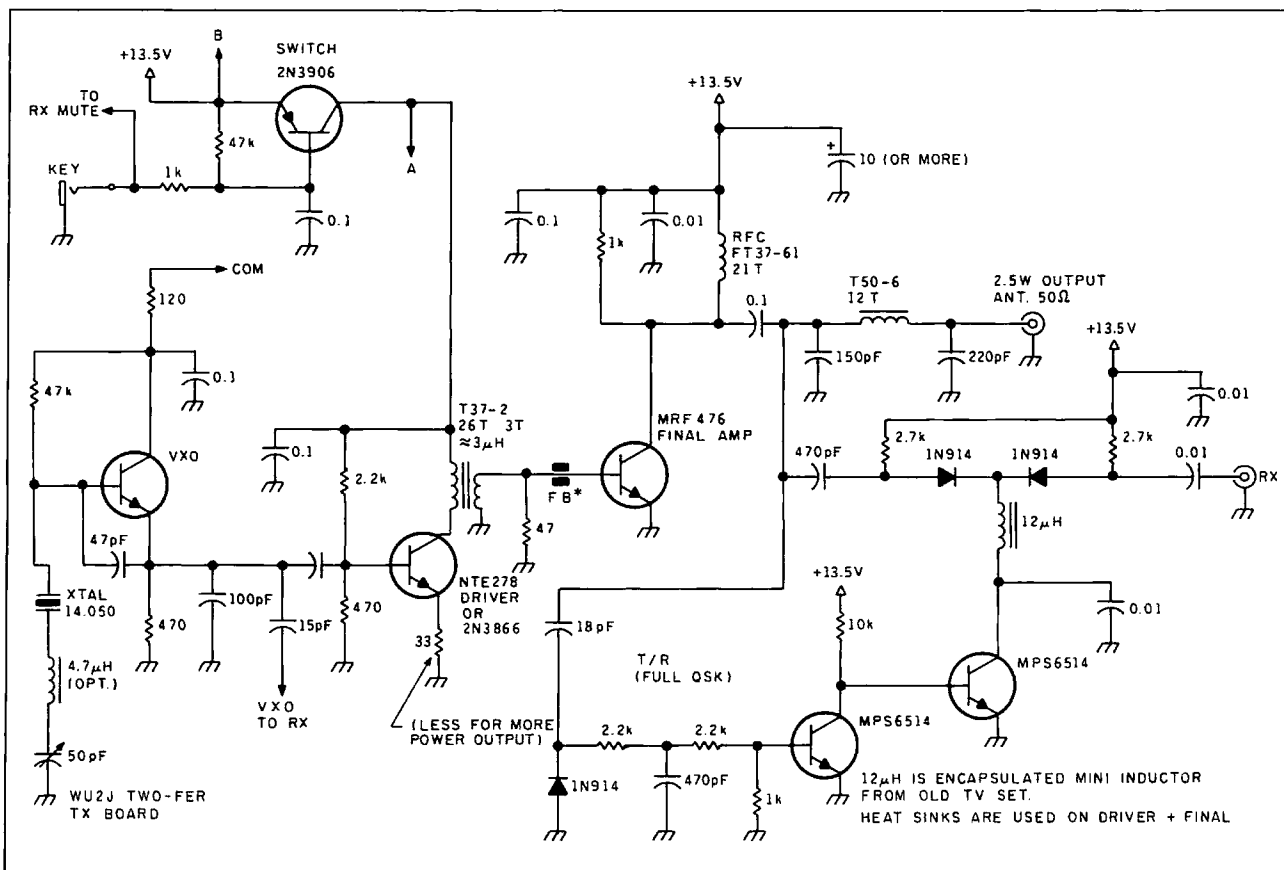


Figure 1. Schematic.

The values for the output filter are for the 20 meter band. I put one of

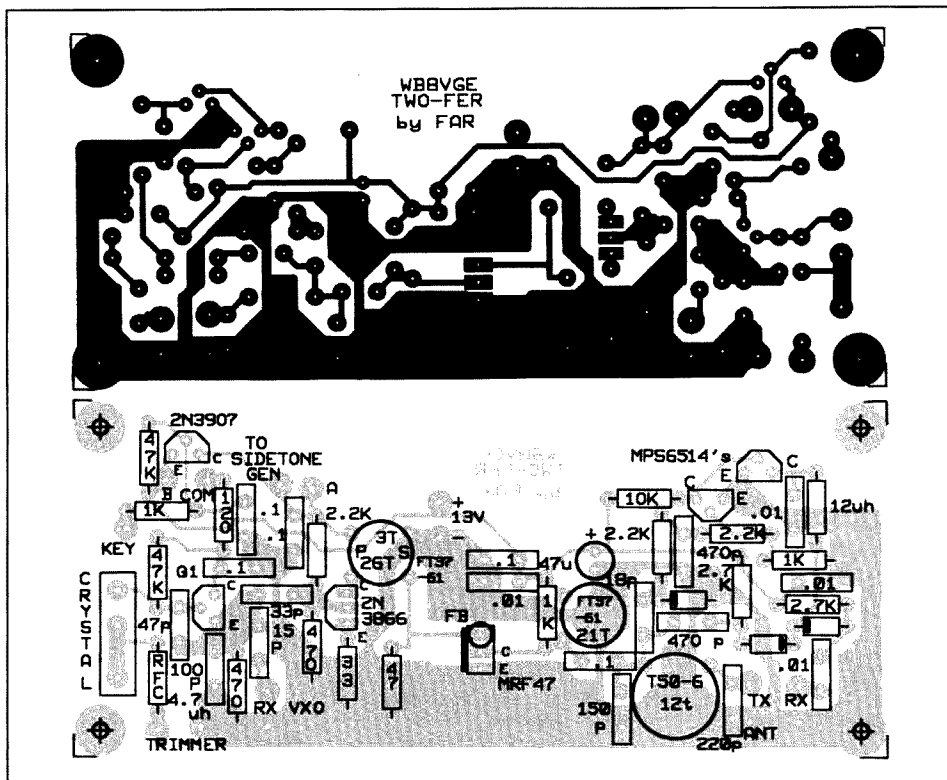



Figure 2. PC board and parts placement.

these rigs on my favorite band, 30 meters, by changing the output filter. I did not change the driver transformer at all. The rig works just fine on 30 meters as well as on the 20 meter band. I did not use the QSK feature as I use my T/R controller instead. I see no reason why one could not put this rig on any other band, with the exception of 10 meters, by changing the

Even though this is simple project, some of the parts may be hard to come by. KA7QJY Components at P.O. Box 3893, Logan UT 84323 has everything you need to get this rig up and running. Send him a large SASE for his part price lists. Of course, a PC board for the project is available from FAR Circuits, 18N640 Field Court.

Next month we'll get back to our charge controller project and put those power MOSFETs to work. 

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While the possibilities of a packet digipeater in orbit tempts the imagination with standard 1200 bps AFSK on FM with the yet-to-be-launched Arsene satellite, other satellite enthusiasts are enjoying great high-speed, 9600 bps packet operation via KITSAT-OSCAR-23.

The satellite was launched on August 10, 1992, representing the product of a cooperative effort between the Korean Advanced Institute of Technology (KAIST) and the University of Surrey in England. Jeff Ward GØ/K8KA acted as Project Manager for the effort. After launch from the French Guiana Space Complex with the TOPEX/POSEIDON scientific satellite and the French S80/T communications experiment, KO-23 spent five months in engineering check-out. Many earth pictures were taken by the excellent dual-camera system and other experiments were exercised. It has even been programmed to "speak" via the 70 cm downlink.

KO-23 was released for general digital communications access on January 15th. Opening messages in several languages were posted to the satellite bulletin board system (BBS) by the Korean control station HLØENJ. Within days, stations around the world were uploading messages, software and picture files. The data transfer capability of this digital amateur radio satellite is greater than any other. Signals are strong and correctly modulated from the transmitter, while the receivers are quite sensitive. The 1300-km-high orbit provides longer access than the UoSAT and microsat series. These factors have made KO-23 the choice for digital satellite fans.

Within a week the request queue was loaded with callsigns on every pass over the United States. Activity is also high in Europe and other densely populated areas. Users quickly discovered the utility of KO-23's digital system and its ease of

use and time in the sky, compared to UoSAT-OSCAR-22 with its lower orbit and slightly higher Bit Error Rate (BER) caused by its transmitter.

Earth Station Equipment

To get active via KO-23 several items are needed: a 2 meter FM transmitter for the uplink, a 70 cm FM receiver with preamp for the downlink, antennas, a terminal-node controller (TNC) with a 9600 bps modem and a PC-compatible computer running special software to communicate with digital amateur radio satellites.

While most stations employ circularly-polarized beam antennas for KO-23 work, some have had reasonable results with omnidirectional antennas such as J-Poles or Lindenblads. Better results come with better antennas, but experimentation can yield surprising outcomes. Steve WB5TTS has been quite successful from deep South Texas with omnidirectional antennas mounted on his truck parked outside his apartment. Any pass over 20 to 25 degrees elevation yields good downlink copy and uplink access.

KO-23 has two uplink frequencies, 145.850 and 145.900 MHz. A simple FM transmit system with 25 to 100 watts Effective Radiated Power (ERP) works well to get into the satellite. Since the transmitter must be operated at 9600 bps, the input microphone amplifier must be bypassed. Simple inexpensive FM transceivers can make good high-speed uplink rigs once the internal drive point (usually at the varactor diode) is found.

For reception of the 70 cm downlink on 435.175 MHz, a scanner or 70 cm FM transceiver with a good GaAsFET preamp and a small beam will do very well. To get digital data from the receiver, the signal must be brought out from the discriminator circuit prior to the audio amplifier stage. In many of today's radios the discriminator circuit employs only one IC, an MC3357 (or similar). Pin 9 is the discriminator output and can be connected



Photo C. Congratulations to KAIST and HLØENJ uploaded to the KO-23 BBS by JH1AOY in picture (.GIF) form.

via a shielded cable to the "audio" input of a high-speed 9600 bps modem.

The easiest way to get going on 9600 bps is to check the TNC manufacturers for high-speed TNCs or TNCs that easily connect to existing high-speed modems. PacComm in Florida has been marketing satellite modems and high-speed TNCs for a number of years. They can be reached at (813) 874-2980. For those interested in some construction work, the Tucson Amateur Packet Radio Corporation (TAPR) has released an updated version of their TNC-2 compatible 9600 bps modem kit. TAPR's phone number is (602) 749-9479. New options include the Digital Signal Processing (DSP) units from L. L. Grace [(609) 751-9705] and Advanced Electronic Applications, Inc. [(800) 432-8873]. When looking for a 9600 bps solution, ask the TNC or modem manufacturer for information concerning connections to your radios. Some are very simple to interface, while others may not even be worth the effort.

The current group of digital amateur radio satellites all use a communication protocol system that differs from that used in terrestrial AX.25 packet networks. Fuji-OSCAR-20 is the only excep-

tion. F-O-20 work requires a Phase Shift Keyed (PSK) modem hooked to a standard TNC, while the others need additional software running in a PC connected to the TNC along with specialized modems.

The satellites employ a broadcast protocol that does not require a connected state to exist between the earth station and the satellite. A user sends a file request to the satellite for a file seen in the directory. The satellite starts the transmission of the file from space. Other stations may also request certain files or pieces of files. The satellite gives each station five seconds of downlink per rotation in the queue. The queue holds a maximum of 20 callsigns. While this may not seem like much, many times a station wants more than one file. While waiting to get all of one, the station may hear and collect pieces of other needed files. When finally requesting the other file, it may already be 90 percent complete, thus requiring very little time to finish. The broadcast protocol has some flaws but works much better than separate connections for each user. It is not uncommon to collect over 500 kb of files in a single pass.



Photo A. KITSAT-A Project Manager Jeff Ward GØ/K8KA and Toshio Tango JR8XPV in the UoSAT control center at the University of Surrey in England. (Photo by JR8XPV.)

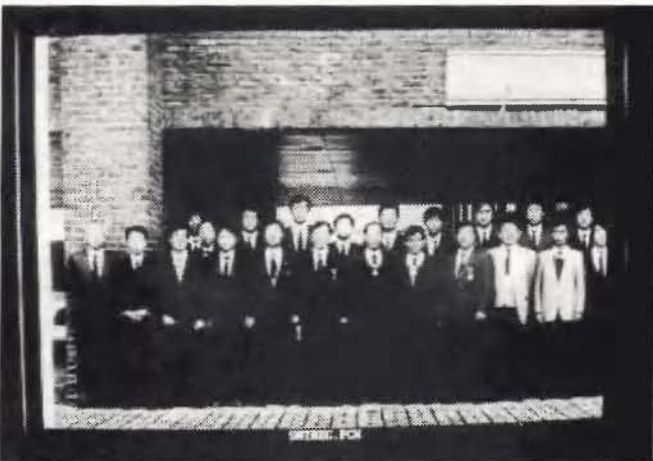


Photo B. Photo of the KITSAT team at the Korean Advanced Institute of Technology uploaded from Korea and downloaded from KO-23 by WB5UUK.



Photo D. Many pictures are uploaded to the KO-23 BBS for worldwide distribution. At 9600 bps transfer can be very fast, even with the shared downlink.



Photo E. Pictures, graphs, drawings and even test patterns can be found in the KO-23 BBS.

The user software is called PB.EXE. The current version was released on April 30, 1992. When running, the program takes control of the communication activity. After setting a few parameters like call sign (KO-23 is HL01-11 for PB) and file grab preference (you may not want to collect everything) the program makes file requests and updates the directory of active satellite files when the satellite is in view. In only a few days many megabytes of disk storage can be filled with E-mail,

images and new software packages from all over. The PB.EXE software is available free on many terrestrial BBS systems. The AMSAT-DRIG (Dallas Remote Imaging Group) BBS is accessible at (214) 394-7438. The software is also provided with *The PACSAT Beginner's Guide* from AMSAT [(301) 589-6062]. AMSAT does not ship the disk separately, but the manual with disk is an inexpensive \$12 in the U.S.

More information on 9600 bps

modems can be found in the December 1991 "Hamsats" column. Other details concerning the high-speed digital satellites are in the October 1991, July 1992 and November 1992 columns.

Since UoSAT-OSCAR-14 began open operation for 9600 bps packet, many changes and advances have taken place. Today, much terrestrial packet mail is sent via satellite. This has caused congestion but has provided a service to the amateur community. With many experi-

ments still to be run on KO-23, and the possibility of a new Katsat in orbit as early as September, concern has been voiced about spreading the satellite gateways to the new hamsat. For now, it's all KAIST experiments and individual packet operation. More 9600 bps satellites are on the way. They work extremely well. In a few years we can expect 56 kbps satellites and compressed digital video, but for now a few megabytes a day via KO-23 will have to do.

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HOMING IN

Radio Direction Finding

Joe Moell, P.E., K00V
P.O. Box 2508
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Computerized Triangulation, Part 2

Ask a group of radio direction finding (RDF) enthusiasts why they enjoy mobile hidden transmitter hunts (sometimes called foxhunts or T-hunts), and you'll get many different answers. These events are social, educational, challenging, exciting, mysterious, and fun. While some think of a T-hunt as an opportunity to joy ride with radios, I prefer to take my time, be methodical, and savor the experience.

However, there are times when haste is mandatory. During hunts for repeater jammers or stations in distress, all mobiles must work together. One operator becomes the search coordinator, gathering bearings from each station and triangulating them to predict the location of the emitter.

Last month's "Homing In" showed how a computer can speed up cooperative T-hunts. You saw how Fast-Workspace, a Macintosh Excel spreadsheet macro program developed by Paul Terlund WB3JZV, triangulates bearings from as many as 20 hunters at once. It calculates up to 190 fixes and determines a refined position estimate in less than a minute using a double-averaging algorithm.

Where's My Balloon?

As a member of Edge of Space Sciences (EOSS), Paul wanted Fast-Workspace to do more than just locate stationary targets. EOSS is a Denver-based non-profit group of hams who promote science and education through amateur radio and high-altitude balloon flights. EOSS launches helium balloons lifting high-tech scientific packages, including 2 meter tracking transmitters.

Successfully recovering 20 pounds of expensive electronics, dozens of hundreds of miles downwind, depends on the EOSS T-hunt team. After touchdown, the beacon's range might be very short due to its location. There is also the possibility that beacon transmitters may fail in flight or at impact. Thus, it's vital for hunters to track the package continuously throughout the flight.

EOSS has launched nine of its own balloons, plus one for another club. With WB3JZV's computer aiding in the search, the recovery rate so far has been one hundred percent.

Of course, the computer doesn't do it alone. A dedicated team of RDFers makes it happen. On the day before launch, Tom Isenberg N0KSR estimates the balloon's touchdown

point, using the latest data on wind direction and speed at various altitudes.

All hunters must use the same map and coordinate system for computerized triangulation. The standard map for EOSS is the Pierson Graphics Colorado State Recreational Map. Hunters put transparent overlays with a grid of 5-mile-by-5-mile squares on their maps. Point 0.0 on the grid (the origin) is selected by Tracking and Recovery Group Leader Greg Burnett K0ELM, based on the predicted landing point.

"We could use aeronautical maps and do the grid in degrees of latitude and longitude," says WB3JZV. "But aeronautical don't have good road markings for hunters on the ground. So we just superimpose our standard grid on the Pierson map and our X and Y coordinates tell us where we are and where the T is."

On Your Marks . . .

As last month's QRM-hunt example showed, triangulation errors increase when cooperating T-hunters are grouped to one side of the target. Field Coordinator Bob Ragain WB4ETT (Photo A) would prefer to have them spaced out around the predicted impact point, but the roads and terrain may make this impractical. Furthermore, the balloon sometimes moves horizontally faster than the mobiles can follow.

While guidance in positioning is given on EOSS flights, each team selects its locations based on its own judgement. Each is assigned a tactical callsign (Station Alpha, Station Bravo, and so forth) for ease of identification during the hectic recovery period.

Unless all stations take bearings on a fast-moving balloon at exactly the same time, the balloon's horizontal velocity will cause triangulation errors. So tracking stations stay in radio contact. The primary net is on the Colorado Repeater Association's 2 meter field repeater, placed at a high point near the predicted impact zone. When teams are out of this repeater's range, they can call on 2 meters to Jim White WD0E in Denver, or on 40 meter SSB via Dave Gilpin KB0LP.

Net Control gives a time mark whenever bearing information is needed, normally at 15-minute intervals. Hunters take bearings at these time marks and relay them via the repeater or base stations to WB3JZV. Standard message format consists of the team's callsign, tactical call, location X and Y coordinates in miles relative to the origin point, and bearing in de-

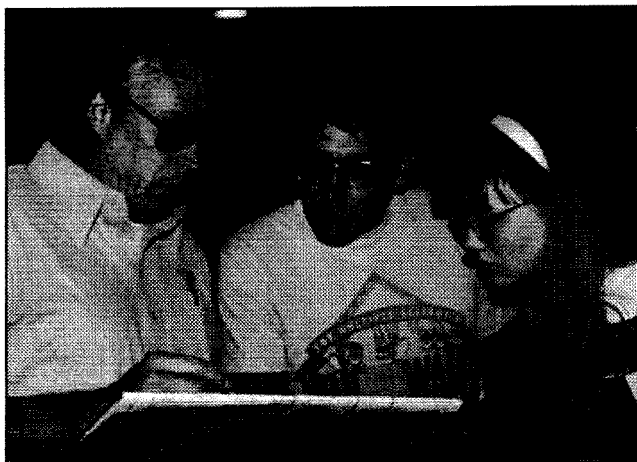


Photo A. EOSS Recovery Team members prepare carefully for each flight. George Riedmuller N0NJM (left), Bob Ragain WB4ETT and Dawn Ragain N0OCW are studying the standard map used by all RDF stations. (Photo by Ann Trudeau KA0ZFI.)

grees with respect to true north.

WB3JZV's FastWorkspace program creates separate spreadsheets for each sample time. Basic data, including launch time, launch point coordinates, callsigns, and tactical calls, is entered only once. As bearings come in for each sample, Paul types all the hunters' location coordinates and bearings next to their callsigns on the Calculations spreadsheet (Figure 1), then mouse-clicks the Triangulate button. Excel calculates the balloon location and displays it and the surviving fixes on an X-Y chart (Figure 2).

The balloon's location and predicted path is announced on the tracking net so mobile stations can reposition themselves as appropriate.

With another mouse-click, Paul activates the Save-and-Revert macro. It puts the prediction from this sample time into the Results spreadsheet and calculates balloon velocity and heading based on location change since the last sample. Excel then automatically saves the Calculations spreadsheet for this sample to disk and creates a new Calculations spreadsheet with operators' names and calls list- ed, ready for the next sample.

Callsign	Name	Tact call	X	Y	B	S1a	SPR	X1	Y1	Erf	Dist	SX
WB3JZV	Paul & Ed	Alpha	47.5	37	286	1	1.2	31.9	41.5		12.4	2
WB4ETT	Bob	Delta	36	44	238	2	1.3			Par		4
AD0Y	Marv	Echo	13	45	106	3	1.4	28.8	42.4		9.2	2
N0EUL	Bill	Golf	46	50	246	4	1.5	23.1	44.0		3.6	3
NOTON	State	Hotel	-27	97	55.6	5	1.6	25.9	43.2		6.3	3
N0JMH	Greg	India	35	35	312	6	1.7			Div5		2
N0JMH	George	Lima	57	31	306	7	1.8	22.8	44.1		3.5	5
K2NA	Larry	November	-33.0	5.0	55	8	1.9	28.6	42.4		9.0	3
W40GEH	Marty	Papa	47.0	27.0	310	9	2.3	29.9	40.2		11.3	2
Declination: (11 deg for magnetic; 0 deg for true)						0	2.4			Div5		
Sample Time:						11:29	2.5			Div5		
Initial Location Estimate (X,Y), DistAvg			20.6	46.6	16.3	2.6	29.5	39.9		11.1		
Standard Deviation (X,Y,Dist)			20.0	18.6	20.3	2.7				Div5		
Refined Transmitter Location			27.6	43.3		2.8				Div5		
Calculation start/stop times:						2.9	30.7	40.7		11.7		
19:44:01 00:00:23						3.4	26.2	41.2		7.8		
balloon 1 fox						3.5	21.1	42.7		3.9		
balloon						3.6	29.0	40.4		10.4		
						3.7				Far	35.8	
						3.8	20.9	42.7		3.8		
						3.9	32.1	39.5		13.4		
						4.5				Far	21.0	
						4.6	27.5	41.8		8.4		
						4.7	36.6	45.8		16.0		
						4.8				Far	21.0	
						4.9	28.7	42.3		9.2		
						5.6	24.2	44.7		4.0		
						5.7	31.3	49.6		11.2		
						5.8				Far	21.4	
						5.9	25.1	45.4		4.5		
						6.7				Far	74.3	
						6.8	24.0	44.9		3.8		
						6.9				Far	27.0	
						7.8	31.1	49.9		10.9		
						7.9				Far	97.9	
						8.9	24.9	45.5		4.4		

Figure 1. The Calculations worksheet for the last triangulation of the October 31st hunt. The moving-target mode is selected by entering "balloon" under the "balloon/fox" cell. (All printouts courtesy of WB3JZV.)

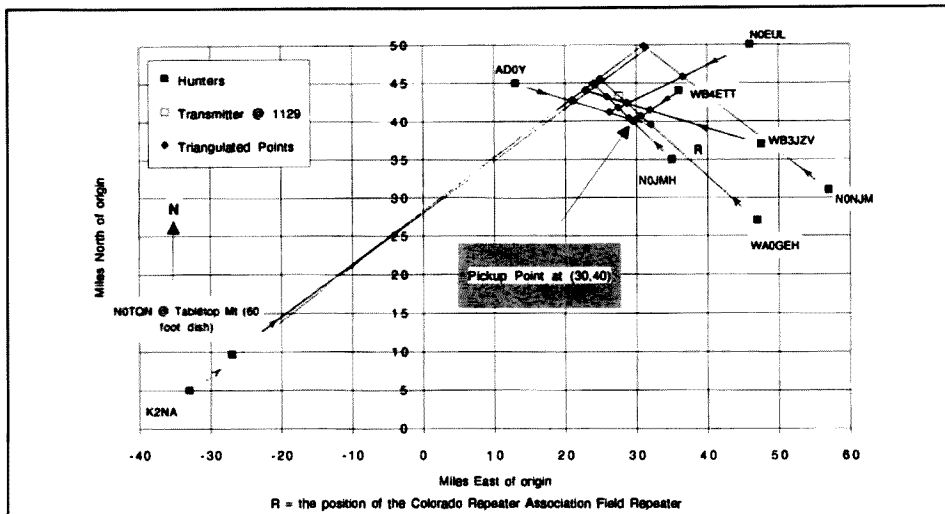


Figure 2. Excel generates a chart of fixes for each triangulation sample. This one is for the last triangulation. WB3JZV has drawn in bearing arrows and identified the actual pickup point.

Time	AvgDist	Xr	Yr	SD_X	SD_Y	SD_Dist	MPH	Heading	Grid Origin	Notes/Altitude
11:32		30.0	40.0						Longmont, CO	Pickup Point
11:29	18.3	27.6	43.3	20.0	16.6	20.3	10	182	Longmont, CO	
11:23	15.6	27.6	44.3	17.8	11.9	14.6	44	56	Longmont, CO	
11:16	8.1	23.3	41.3	9.0	5.0	6.4	56	61	Longmont, CO	17k feet
11:10	6.2	18.5	38.7	7.6	2.7	5.1	41	34	Longmont, CO	
11:00	15.5	14.6	33.0	19.7	6.1	13.7	6	46	Longmont, CO	42k feet
10:45	12.5	13.6	32.0	15.8	6.0	11.5	35	69	Longmont, CO	92k feet (max)
10:30	15.0	5.5	28.9	22.0	6.6	17.4	33	58	Longmont, CO	
10:15	26.3	-1.5	24.4	39.4	17.2	34.0	93	60	Longmont, CO	
10:00	74.8	-21.6	12.9	143.0	39.7	128.2	80	262	Longmont, CO	
9:45	43.2	-1.8	15.5	86.0	26.8	79.0	72	84	Longmont, CO	
9:28	<Launch>	-22.0	13.5	xxx	xxx	xxx	xxx	xxx	Longmont, CO	Longspeak MSch

All distances and standard deviation units are statute miles.
SD_X is the standard deviation over all x-coordinates.
SD_Y is the standard deviation over all y-coordinates.
SD_Dist is the standard deviation over all distances from initial location estimate (aka Figure of Merit).
9:45 and 10:00 estimates were the worst with SD_Dist of 79 and 128 miles respectively.

Figure 3. Excel adds a line to the Results chart after each sample and estimates the balloon's speed and heading. Mobile T-hunters use this data as they attempt to follow the balloon's path.

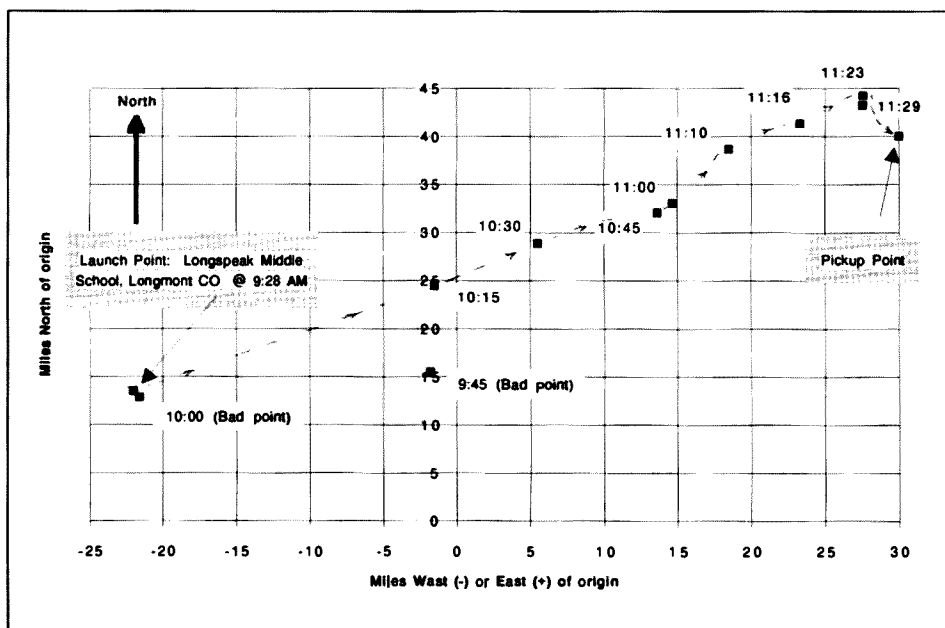


Figure 4. The scatter chart of data in the Results spreadsheet shows the balloon's complete flight path.

A Typical Flight

EOSS flight #9 lifted off from Longmont, Colorado, at 0930 MST last October 31. The payload dangling from the 70-foot balloon included a telemetry and command module with two 2 meter tracking beacons. There was also a video system with a black-and-white camera and a 1-watt ATV transmitter. A commandable gimbaled mirror gave the camera views of the ground, the horizon, and the balloon above.

Balloons for scientific flights will eventually break and drop the payload, which parachutes to earth. But the time and altitude at which breakage occurs is very difficult to predict and control. On an EOSS flight in May 1992, the payload unexpectedly stayed in the air for almost 18 hours and ended up in Nebraska, almost 220 miles from the launching point! One goal for this flight was controlled separation of the payload from the balloon, and the package included a device to release the payload on command.

Fourteen T-hunters provided bearings from their mobiles or base stations at one time or another during the flight. The greatest number of bearings triangulated at any one time was 12 at 10:45 a.m., when the bal-

"WB3JZV uses the Station Performance Sheet and practice runs to help searchers take better bearings. 'Before the balloon goes up, I put on a little accuracy check exercise for those stations that care to partake,' he says."

loon reached its maximum altitude of 92,000 feet. The payload drop mechanism worked perfectly, and the package began its descent.

Figures 1 and 2 show the calculations spreadsheet and scatter chart for the last set of bearings, taken just before loss of signal as the package neared touchdown. The triangulated location at that time was only four miles from the eventual pickup point.

The RESULTS.FINAL spreadsheet (Figure 3) and scatter chart (Figure 4) clearly show the balloon's path from Longmont to the grasslands near the town of Briggsdale. Erroneous predictions at 9:45 and 10 a.m. occurred because most hunters were clustered in the predicted touchdown area, 60 miles northeast of the rising balloon.

The Station Performance Sheet (Figure 5) summarizes how each RDF team performed, as judged by the number of times that the program rejected fixes based on that station's

Station Performance Sheet													
Call Sign	Name	Number of Rejected Points at each Sample Time										Total Triangula Pts	
		9:45	10:00	10:15	10:30	10:45	11:00	11:10	11:16	11:23	11:29	Rejected	Possible
AD0Y	Marv		1	1	0	1	0	1	3	4	2	13	82
N0RHE	Tim						2					2	9
WA0GEH	Marty		6	4	4	3	2	1	5	2	2	29	82
N0PCZ	Lonnia	3	2	4	3	6						18	48
N0EUL	Bill	1	1	5	5	5	6	3	4	2	3	35	89
K2NA	Larry	5	7	3	4	5	2	2	5	3	3	39	89
N0TQN	State				4	6			5	3	3	21	46
WB3JZV	Paul & Ed	5	4	8	6	6	5	3	3	2	2	44	89
WB4ETT	Bob	6	4	5	4	6	4	3	5	3	4	44	89
K0ELM	Greg	3	5	8	7	3	4	3				33	56
N0LEO	Roger	5	2	6		6						19	38
N0JMH	Greg	4	3	6	6	8	4	7	8	3	2	51	89
N0SBD	Bo		3	10	5							18	30
N0NJM	George					11	5	2	9	4	5	36	52
Number of Possible Points: (by a given station)		7	10	10	10	11	9	7	9	8	8		

Figure 5. The program computes this summary of RDF accuracies after the flight. Stations with bold call signs were fixed, while the remainder were mobile.

bearings. Rejections occur because bearing pairs are parallel or divergent, or when a fix is too far away from the main cluster of fixes at that sample time.

The lower the rejection rate, the better. It is unlikely that any station will ever achieve zero rejections, especially when hunters congregate on one side of the target,

as they do early in the flight.

Sharpshooters' Secrets

WB3JZV uses the Station Performance Sheet and practice runs to help searchers take better bearings. "Before the balloon goes up, I put on a little accuracy check exercise for those stations that care to partake," he says. "I go somewhere within the

footprint of the field repeater, fairly close to it. Everybody picks their RDFing spot, then calls in and gives their bearing to me and their grid location. I plug the data into the computer and tell them what their bearing error is."

"I've questioned a couple of guys who get real bull's-eyes, less than a degree of error," Paul continues.

"They are consistently red-hot hunters. Before they sight down their antenna booms toward the signal, they take compass bearings on a distant terrain feature from various spots within a 30-foot radius. Then if they're in a local magnetic disturbance, they can tell it and move as necessary. When taking bearings, they take several readings from nearby locations to average out multipath."

I tried out WB3JZV's programs and they worked just fine. I used them to generate the examples in last month's column. If you would like to experiment with computerized triangulation, they are available for your non-commercial use.

For a 3.5" Macintosh disk with macros and spreadsheet files, send \$10 to Paul Ternlund, 15459 East Saratoga Place, Aurora CO 80015. Specify standard or high density disk type. As usual, neither 73 Amateur Radio Today nor I can guarantee this offer. You will also need Microsoft Excel version 3.0 or higher to run the macros.

Congratulations to Paul and the rest of the EOSS crew for developing educational and enriching uses of amateur radio. For more information on EOSS, contact Vice President Marty Griffin WA0GEH, 1647 East Geddes Circle North, Littleton CO 80122.

73

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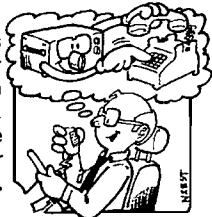
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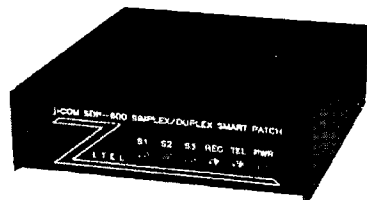
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Keep On Walkin'

Last month, we were discussing walkies. Let's take up where we left off.

If your walkie is getting power, something should be happening. If the radio is still completely dead, it is very likely that no power is getting to the circuitry. Once you've eliminated bad connections, the power switch, fuses and such, the next place to look is the voltage regulator. Depending on the rig's design, there may be more than one. Especially if you get no computer operation (no display or response to keypresses), check that power is getting to the micro. If not, trace it back until you find it. Although today's walkies use CMOS micros, most of which don't require regulated voltage, many still use regulators, more for the purpose of isolating the micro from possible voltage spikes or reversed polarity than anything else. A dead regulator will, of course, shut down the micro, and it may cause the rig to look totally dead when it really isn't.

If the rig does turn on, but doesn't

The Tech Answer Man

work properly, you must troubleshoot it like you would any radio. Before you do, though, it pays to give some thought to the specific problems walkies encounter.

QRM

Many hams use their walkies as mobile rigs. Some even use them as base stations. Suddenly, they are complaining that their receivers don't work properly. For some reason, they can't hear the local repeater. Everyone else can, so something must be wrong with the walkie, right?

Not necessarily. The front ends in walkies are rather small, and there usually isn't room for much in the way of bandpass filtering. Also, nearly all new rigs have very wideband receiving capabilities, making filtering impractical. The result is that, when connected to an outdoor antenna, the average walkie is swamped with out-of-band signals, overloading and desensitizing the front end. Remember, walkies are designed for use with those little rubber dummy loads they come with, so the front ends are optimized for sensitivity, not resistance to overload.

By the way, an exception to this "rule" is the Radio Shack HTX-202,

which does not have extended-coverage receive. Instead, there's lots of bandpass filtering, making that radio pretty immune to signals which will wipe out other sets. Despite the rumors going around on packet radio, there are no modifications to enable extended receive on this rig; the hardware just won't support it. Oh well, there's a price to pay for everything, right?

If you encounter a receiver desense problem, the first thing to do is switch to the rubber duck antenna and see if it goes away. I remember having such a problem in Miami once. Using a quarter-wave mobile whip on the roof of the car, I could get into the repeater just fine, but I couldn't hear it very well. I switched to the duck and, even inside the car, I could hear it just fine. The problem is even worse with big base station antennas; there's just too much signal strength. These problems do not indicate any malfunction of the radio, and you shouldn't go in and adjust anything. You just have to accept the limitations of such a small radio.

Speaking of antenna issues, I've seen many instances of worn or broken BNC connectors causing trouble. Especially if you connect various antennas and cables, it can wear out. If your receiver sensitivity suddenly drops way down or becomes intermittent, take a good look at that BNC. If the center receptacle is obviously worn, you may need a new jack. If it

looks OK but the problem persists, check the connection to the PC board. In some rigs, wobbling of the connector can crack the connection. Also, sometimes the BNC can simply be loose. If it is, you can bet your ground connection is no good. With most rubber ducks, it doesn't matter because they don't use the ground anyway. But, when you go and hook up a mobile antenna, it doesn't work properly. The fix is simple: a good, solid connection through a tightly secured BNC.

Hello? Hello?


Another common walkie problem is a blown speaker. If you use the rig in the car, you probably have to turn it all the way up, or nearly so, in order to hear it. Some rigs which put out 250 to 500 milliwatts of audio have speakers which are only rated for 100 milliwatts! Under normal conditions, it's no problem. But, when you blast it all the way up for a while, that poor little speaker's voice coil may fry. If the rig works via the earphone but the speaker is silent, disconnect one wire from the speaker and check the voice coil with an ohmmeter. It should either be OK or be open. If it's open, you need a new speaker.

A long time ago, I had an odd experience with this problem. I bought a used walkie which apparently had had a blown speaker. The previous owner had replaced it with a generic one. The



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radio worked, but it always seemed off frequency on receive! Oddly, when I pulled it apart, it worked fine. As soon as I put the two halves of the case together, it got distorted again. After scratching my head for a long time, I noticed that the back of the speaker was very close to the discriminator coil. And, the replacement speaker had no shielding behind its magnet. You guessed it—the magnetic field was detuning the discriminator. I got a new speaker from the manufacturer and the problem went away. In today's micro-mini world, you pretty much have to get most parts from the radio's maker. Otherwise, you risk winding up with a kludge that doesn't work quite right.

Lookin' Bad

Today's walkies use LCDs to show your operating frequency and other parameters. I've covered LCD problems in previous columns, but I'll go over the basics again here. Unless the rig has been dropped and the LCD is obviously broken, most likely a display problem is caused by bad contact between the PC board and the display. If the radio works properly but all or part of the display is missing, chances are that water, cigarette smoke or another contaminant has worked its way into your rig. Most LCDs are connected via conductive rubber strips pressed between the display's edge and contacts on the board. It takes good, clean contact and

reasonable pressure for it to work. For that reason, the LCD is mounted such that it is pressed pretty hard against the board. Sometimes, the radio's case is used as a housing, with the board being screwed up against the display. Other times, there's a frame for the LCD, and the whole thing comes out of the case as a unit, because the frame is mounted to the board. The frame approach seems to work better, but either scheme can allow junk to get inside and mess up the display. To clean it, you must separate the display from the board, clean the edge of the display, the conductive rubber and the board, and then put the whole thing back together again. I've successfully used isopropyl alcohol. Just be very careful not to drip any on the rig's plastic case or display window, because many plastics are permanently damaged by contact with alcohol. The conductive rubber strips don't seem to have any problem with it, though.

Getting Pushy

Keypads also can get gummed up. If you must disassemble one for cleaning, be extra careful when you pull it apart. Many rigs have individual buttons which are not joined together, and it is very easy to lose them. Always remove the PC board with the radio's face pointing down, in order to keep the buttons in place. Even if you don't lose any, they often get turned around

or out of order, so take a look from the front before you screw it all back together again. I can't count the times I've forgotten to do that and then had to take it all back apart immediately after reassembly. Arrgh.

Go To It

Other than these walkie-specific issues, HTs are no different than any other radios, and normal circuit problems must be troubleshooted in the usual way. So, get out that scope and go to it! Now, let's look at a few letters:

Dear Kaboom,

I know this is kind of a weird question, but I'm hoping you can help. One of our lovely California earthquakes has caused a broken circuit to the ceiling heater in our bedroom. I have no idea where the break is. Any idea how to find it?

Signed,
Brrrr

Dear Brrrr,

Yes, this is an odd question, but I believe ham radio can come to the rescue! You're a ham, so why not use some RF? First, be *absolutely sure* that all power is disconnected from that grid of wires. I'd disconnect your main circuit breakers to be sure. (Just for safety, double-check with a voltmeter.) When you know there's no power there, try a little QRP! What I'm suggesting is that you make a battery-

powered, very-low-power transmitter. A milliwatt will do. Then, connect it to the wire feeding the heating grid. Now, take a small radio and move it along the ceiling until you find the signal. You should be able to find the break pretty easily; the signal will drop way off. If that doesn't work, you could try a little more RF power (maybe a watt) and a field-strength meter. Either way, I'd use a fairly low frequency, perhaps 80 meters, so that you don't mistake nodes in the wave for the broken wire. Good luck!

Dear Kaboom,

I've started building a 15 meter QRP rig and discovered that I've used carbon film resistors instead of the carbon composition resistors called for. Should I replace them with carbon composition parts? Is this substitution likely to affect the performance of my rig?

Signed,
EI Switcheroo

Dear EI,

Yes, it will affect performance—the rig may work better! Seriously, though, carbon film resistors are more expensive and made to tighter tolerances than carbon composition units. As far as I know, the film resistors are no more inductive than the comp ones, so it should work fine. Good luck with your rig!

73 and see you all next month.

HAM HELP

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. You may also upload a listing as E-mail to Sysop to the 73 BBS, (603) 924-9343, (8 data bits, 0 parity, 1 stop bit, 2400 baud), on Special Events Message Area #11. Specifically mention that your message is for the Ham Help column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

We want to exchange our vintage communication receiver, Radio Holland Type BC348W valve-type, frequency coverage 200 KHz to 18,000 KHz (in 6 bands). Receives AM, CW, and SSB and is in perfect working condition. Would like to trade for any QRP SSB amateur band transceiver with at least 20 meters, but would like all the bands. Must be in working order. We also want to exchange a Drake TRM-24 100 watt Marine band (2, 4, & 8 MHz) SSB transceiver. Has no VFO but has 11 preset crystal channels. Will trade for amateur band QRO or QRP transceiver. Does anyone have information on converting the Drake to the amateur bands, have a schematic diagram, and/or have the address of the Drake Company? Address: Arshad H. Quadri (AP2AHQ), Larkana Amateur & SW Listeners

Club, No. 1989/A 1 Shaikh Street, Karma Bagh Larkana 77150, (Sindh) Pakistan. Thank you in advance.

Wanted: Manual and schematics for EICO 722 VFO. I will pay copy and shipping charges. Gary Trudel VE3MPQ, Windsor Ontario, Canada. Tel. (519) 944-2962.

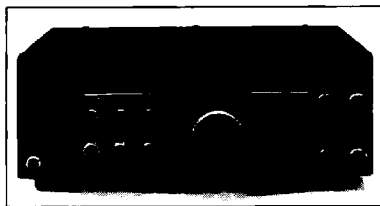
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NEVER SAY DIE

Continued from page 4

businesses. But I know that almost everyone listening is going to continue a life of quiet desperation, nailed down to a lousy job somewhere, lighting rush-hour traffic twice a day.

Sure, I wish that hams would read my book (\$13 postpaid from Uncle Wayne's Bookshelf), subscribe to my *What To Do* newsletter (\$10 for ten issues), and get excited about changing their lousy state and our lousy federal government. A few have read it. And a few of those are talking about action and forming groups.

When I ask for a show of hands at my talks . . . how many of you have worked over 300 countries? Maybe one hand goes up. I ask who's been active on OSCAR. Another hand goes up. How about RTTY? Two hands. How about 75 meter DXing? No hands. How about 2m sideband? Two hands. How about 6 meters? No hands. How about moonbounce? No hands. Packet? A couple dozen hands. SSTV? No hands. ATV? One hand. 10 GHz? No one. Hidden transmitter hunts? Couple hands. MARS? Three hands. Contests? Four or five hands. I'm wondering if Uncle Wayne's Bookshelf should stock enema bags.

None of this cost a lot of money. Most of my life I haven't had much money. I still don't, in my own mind. But a lack of money has never stopped me from doing different things

in amateur radio. It costs peanuts to whip together a pair of microwave transceivers and head for the mountains. I remember Howie W2QHH, who had around two-and-a-half zillion certificates collected. He ran maybe 100 watts to a dipole, and he had a ball.

I decided to have some fun one DX contest weekend and fired up my rig on 20m. I wanted to see if I could work 100 countries in one weekend on 20m. Well, I did it . . . just barely. My 100th was just seconds before the end of the contest. Will I ever forget the time I decided I'd work all 50 states on 75m. It took me three nights to do it, and that wasn't even during a contest. Three nights, all night.

My first DXpedition was to Navassa Island, back in 1958, and I'm still talking about it and showing pictures. I'll never forget a minute of that trip . . . boy, that was exciting! We came damned close to getting killed several times.

Well, I'll tell you what. Instead of having anything in mind to talk about at Dayton this year, I'll let you ask questions . . . if you have any. Otherwise I might start talking about things which will be of little interest to you, like some of the things I write about in my editorials . . . like how the mind/body works, or how to cure all illnesses, to lose weight, to fix our rotten educational system, to cut state and federal expenses, to get work, to make really big money, to cut crime by around 80% or more, to cut taxes sub-

stantially, to live longer, to get rid of welfare, and other non-ham matters which are probably of no interest whatever to someone who's driven all the way to Dayton for a super ham-fest. You want to scrounge the flea market and to see all the new ham gear on display, not get involved with politics or health things.

Heck, if you had any interest in living very long you wouldn't have that huge beer belly hanging out under your tee shirt, be smoking or drinking beer, right? There I go being a scold again . . . being mean. I really do appreciate the hundreds of you who've stopped by the 73 magazine booth to thank me for getting you to lose weight and stop smoking. I also enjoy it when someone tells me that it was my editorials that got them to go into business for themselves, giving them the first real freedom they've had since they were kids.

The 73 Booth

Speaking of the booth, we aren't going to have one this year. Now, I want to tell you that that was a tough decision, but we added up the outrageous cost of the booth space, of shipping the booth stuff out to Dayton (and back), and sending out three people to stand in the booth. Then we added up what we usually take in selling subscriptions and books. Whoa there, we've obviously got to stop booting at Dayton. It still makes economic sense at all the other hamfests we attend, but the sales at Dayton just

don't justify our buying a booth any longer.

A couple of our staffers will still be going, but instead of standing around in the booth for three days, they'll be going around the hamfest visiting the exhibitors to see what's new and to talk about advertising, new product reviews, and so on. If I can find a place to park anywhere near the arena I'll be wandering too, so say hello when you see me. Yes, of course I'll have some discount subscription forms with me. David Cassidy suggested I push around a shopping cart full of my books to sell. Not a bad idea. I could sort of live out of it like a bag lady since I won't have a booth to store the usual ton of stuff I can't stop myself from bringing along . . . HT, cameras, a few samples of my CDs, my laptop computer, and so on.

So I'll try one more year giving a talk and see if there seems like enough interest for me to bother next year. My talk is at 1 p.m. on Saturday, if you aren't too busy haggling over something in the flea market to bother. Maybe it'll rain again and help pack my room. I'll do a little rain dance.

Another CQ?

Sure enough, a *third* magazine with that title! There's the ham contest magazine, then *Congressional Quarterly*, and now *CQ (Communications Quarterly)*, published by Digitel. Being in the communications equipment business, I suspect they've never

Continued on page 88

MODEL 43



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Teaching Through Learning Channels

In almost every case, the success or failure of any course, amateur radio included, depends on the effectiveness of the person in front of the room. This is one reason why teachers are encouraged to keep going back for in-service courses and to continuously keep abreast of new educational techniques.

One of the best postgraduate courses I ever took was something called "Teaching Through Learning Channels." The goal of the class was to teach instructors how to observe the signals that students exhibit, indicating how they prefer to learn. These signals are the continuous reference points by which we, as teachers, recognize what it is that students need in order to learn.

I believe that these skills of observation are crucial to the development of good teachers and instructors. Being a skilled observer in the classroom can make the difference between being a good teacher and being a great one. Learning to observe and interpret

the kinesthetic/tactile, auditory and visual clues that students of all ages demonstrate in a class will enable the teacher to relate these clues to the students' learning styles.

A really professional teacher knows the value of being flexible in his or her teaching style. Teaching, as well as learning, should be an ongoing process. The instructor who has learned to expand his or her style to include concrete, abstract, sequential and global strategies will inevitably be the one whose students get the best of meaningful learning experiences.

I get many letters from teachers who want to know how to keep the motivation high with young people in a ham radio program. The answer is really the same as it would be for the successful teaching of any discipline: The teacher must continuously increase his or her knowledge, refine his skills, and expand his teaching resources.

Studies have shown that students learn best when a teacher teaches to the preferred learning channel of that person. A learning channel is a way or method by which an individual is able to best process information: visual, auditory, or kinesthetic. The teacher of amateur radio is fortunate enough to have the opportunity to be able to hit



Photo A. Concrete/sequential strategies include step-by-step directions to complete a task.

all these learning channels in creative and stimulating ways.

Let's define some of these techniques so that any teacher or instructor reading this can begin to incorporate a fresh approach into his own teaching style.

The Concrete/Sequential strategy includes doing such things as having field trips organized step by step, with a goal; structured demonstration lessons; simulations that follow the rules; using step-by-step directions to complete a task; and using concrete

materials and following directions. The ham radio instructor can plan field trips to local museums with ham radio stations or electronics exhibits; or plan a visit to the radio room of a major communications center in the area, such as police or fire radio and dispatch rooms; or plan a visit to a local ham who has an impressive station.

The Concrete/Global strategy involves giving choice-optional assignments involving real things, concrete problem-solving simulations, learning through trial and error and using real

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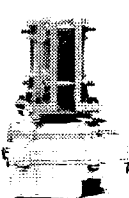
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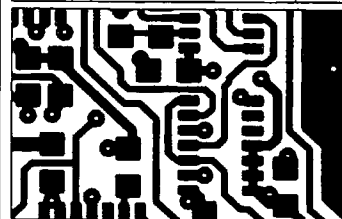
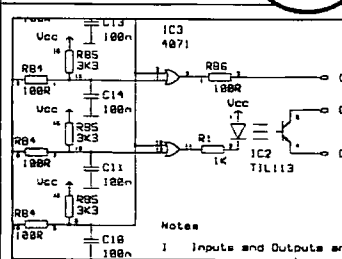
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objects, committee work on real projects, and discovery learning. There are hundreds of basic electronics experiments applicable to every age group which can be used in an exciting way in the classroom. If you have a large group, break them up into smaller units and provide materials for each group to work with and record their results.

The Abstract/Sequential strategy includes lectures, with questions and answers, in a step-by-step progression; audio and/or video tapes in a step-by-step sequence, almost all textbooks, explaining theories through deductive reasoning, getting the main idea through sequential presentation, and programmed instruction. The good teacher will choose the appropriate textbook, handout materials, etc. for the age and interest level of the group and use this as only one of the teaching strategies to be utilized in the classroom.

The Abstract/Global strategy is having open-ended think sessions, group discussions, allowing think time for reflection before beginning a project or assignment, optional reading assignments, and allowing the students to get their own "Aha." Having a student at the front board during the group discussions is a good idea. The student can make a list of the key words of the discussion. When the class gets divided into triads or small groups after the discussion, they can refer back to the key words and use them to plan their own next steps for their task.

Learning Channel Inventory

About one week into the new term, I administer the following inventory to my classes. The kids have fun filling it out, and I am able to use the results to plan my initial teaching strategies for that particular group.

Check four to six statements that identify how you prefer to learn.

When learning, I prefer to:

- Work with real things.
- Talk to myself while reading a book or questions on a test.
- Read material about what I'm learning.
- Sketch or doodle while learning.
- Hear things explained first.
- Watch a film or video.
- Work with materials related to what is to be learned.
- Listen to tapes, the radio or recordings.
- Watch someone illustrate or demonstrate the information.
- Perform through simulations, games, role plays.
- Listen to experts describe and explain the information.
- Look at charts, maps, graphs or pictures.

Plan your teaching strategies to match the results you get on your inventory. It's probably safe to say that the more you are able to correlate the two, the more effective your teaching will be. Be flexible, monitor your results, and be involved with the learning process of your students. Teaching



Photo B. Ham radio in the classroom lets you use a multimedia approach to learning. Shown here: An ATV demonstration.

amateur radio allows you to have a multimedia approach to learning. Take advantage of it!

Be sure to join us at the Dayton '93 Hamvention Youth Forum on April 24th. I'll be showcasing youngsters

from all across the country. We've got a dynamic, accomplished group of children who will be speaking this year. Please come and meet them and bring some children along with you. C U there.

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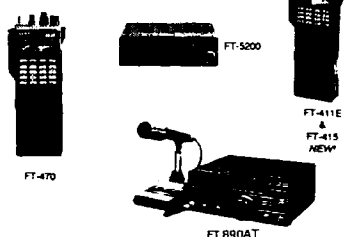
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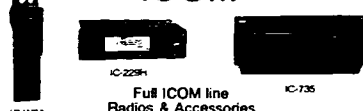


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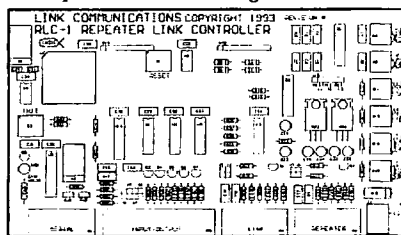
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The HatCam

Thanks to the latest in miniature video technology, the ability to carry a complete ATV transmitter and camera on top of your hat is now a reality. Imagine an extremely portable ATV system that weighs in at under eight ounces (with a nine-volt battery) and gives you a range of thousands of feet. With the HatCam system, you only need to turn your head to point the camera. This is the perfect setup for special events, hamfests and ATV demos. No cumbersome clutter of cables are needed to hook up this station—just put on your hat and you're ready to transmit.

The HatCam, shown in Photo A, was designed by Jeff Brown N8UEJ and Dave Pelaez AH2AR/8, and first shown at the 1992 Dayton Hamvention. There

are two items that make the HatCam a reality. The four-ounce miniature TV camera from Micro Video Products (the MVP Series V) and the Micro-ATV transmitter described in the July 1991 issue of 73, page 9. The Micro-ATV transmitter is the size of a postage stamp and puts out enough power (80 mW) for a decent range.

The MVP-V Miniature TV Camera

The truly remarkable achievement is the incredibly small B/W TV camera from Micro Video Products [Telephone: (800) 473-0538]. The MVP-V (see Photo B) measures just 1-1/4" square by 2-1/4" long. It fits neatly in the palm of your hand and is the smallest camera I've seen so far. At \$289.95, it's surprisingly affordable for a camera of its size. The MVP-V has a built-in wide angle lens, an automatic electronic iris and an excellent light sensitivity of 2 lux. Its small size and superb performance should make it a popular



Photo B. Close-up view of the Micro Video Products miniature video camera (MVP Series V).

choice for R/C model ATV, Handle-Lookies, as well as a hamshack camera you can mount just about anywhere.

Build Your Own HatCam

Once you've acquired the transmitter and TV camera, all you need is a baseball cap. The MVP-V TV camera should be mounted securely to the bill of the cap with a 3/8" long 1/4-20 bolt. Try to mount the camera near the edge of the bill so that the hat isn't in the field of view. Next, run the video/power cable around the edge of the cap so that you have enough cable to reach the back of the cap.

Mount the ATV transmitter in a small plastic project box (a case from a kid's walkie-talkie was used for the HatCam shown in Photo A). Make sure you have room in the box for one or two 9-volt batteries, the video and antenna connectors, and the power switch. You can use a small 450 MHz rubber duck for the antenna. If you modify the case from a kid's walkie-talkie, you can use the on-board telescoping whip for the ATV antenna. Now just clip your transmitter to the plastic strap on the back of your baseball cap, hook up the cable, and you're ready for some real portable ATV fun!

You can expect about 30 minutes of life if you operate both the camera and the transmitter from one 9-volt battery. Two batteries in parallel should give you upwards of an hour. If you run with the batteries in par-

allel, be sure to wire a 1N4001 blocking diode from the positive terminal of each battery to the common positive supply point. As an alternative, you can power the transmitter and camera from separate batteries.

The Future

Of course you can use the miniature components of the HatCam for your own special applications. You no longer need a 1/4-scale R/C plane to carry a large ATV transmitter and camera. Many of the smaller planes should have enough lift to fly this system. R/C cars and even boats are other likely candidates. How about a Dog-Cam? Now you can see your pet's point of view as it catches a Frisbee!

I imagine that as cameras and transmitters get even smaller, you might even see a practical version of the Dick Tracy video wristwatch in the not-too-distant future.

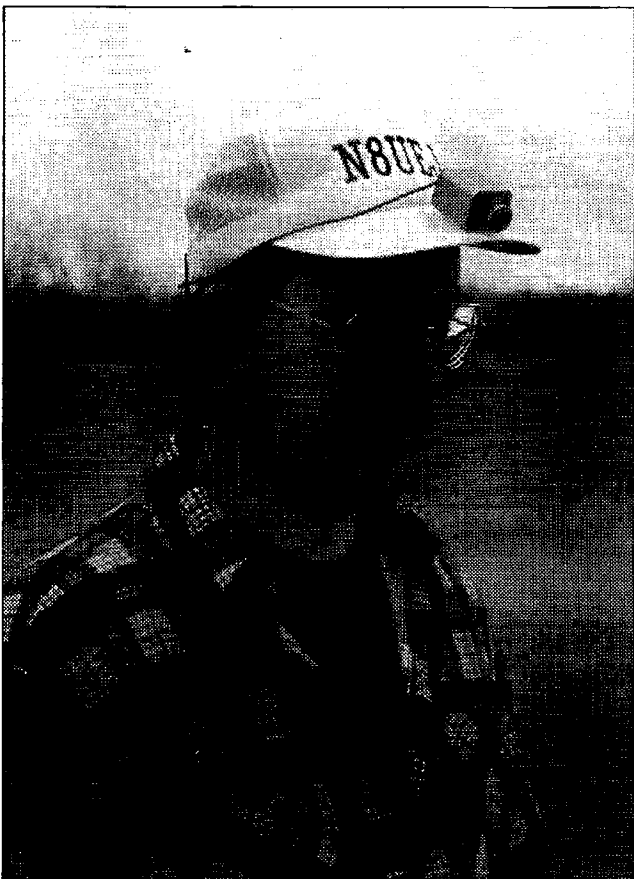


Photo A. Jeff Brown N8UEJ demonstrates the HatCam. The camera is attached to the bill of the hat and the transmitter clips onto the plastic strap on the back.

HATCAM SUPPLIERS LIST

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SPECIAL EVENTS

Ham Doing Around the World

APR 3

AJAX, ONTARIO, CANADA The South Pickering ARC, Inc., and the North Shore ARC, Inc., will sponsor a Flea Market from 9 AM-2 PM at the Pickering High School on Church St. North, Pickering Village, in Ajax. Vendors: To register in advance, contact South Pickering ARC, Inc., P.O. Box 53, Pickering Ontario, L1V 2R2, Canada. Make checks payable to the South Pickering ARC, Inc. For info, contact: Ron Brown VE3WZ, (416) 839-3711; Kim Becker VE3SVZ, (416) 571-6883; Garry Brisbane VE3REP, (416) 683-4335; or Bob Partridge VE3SRD, (416) 839-75850.

CHESAPEAKE, VA The 8th annual Chesapeake "SpringFest '93" Amateur Radio/Computer Show will be held at Virginia Beach Pavilion from 8 AM-3 PM. VE Exams by CDXA: Bring original/Copy and ID. Talk-in on 146.970. Dealers contact: Preston P. Ippock N4SHI, (804) 543-4610. Flea-Market contact: Robert M. Holt N4SFH, (804) 487-1896, or Chuck Moseley KD4IUJ, (804) 545-1303. Sponsored by Chesapeake ARS.

NW ROCHESTER, MN The Rochester ARC will hold their annual Hamfest at John Adams Jr. High School, 1525 31st., NW Rochester, starting at 8 AM. Talk-in on 146.82 (WOMXW/R). Write to Scott Sheratt N6VB, 6982 Indigo Ct., NW Rochester MN 55901.

WILLIAMSBURG, VA The Williamsburg Area ARC will sponsor ARRL Exams April 3rd. Contact Andrew Swanson WJ4X, (804) 253-2811.

APR 3-4

SPOKANE, WA The 16th Annual Inland Empire Hamfest/Computer Show will take place at Spokane Youth Sports Bingo Hall, East 2230 Sprague Ave. Set-up Fri., Apr. 2nd, 12-5 PM. Contact "Ike" Brown KF7PU, (509) 459-2667.

APR 4

RALEIGH, NC The Raleigh ARS will present its 21st Hamfest/Computer Fair in the Jim Graham Bldg., NCS Fairgrounds, from 8 AM-4 PM. To pre-register for VE Exams, contact Vince AA4MY, (919) 847-8512. Dealers, contact Rollin Ransom NF4P, 1421 Parks Village Rd., Zebulon NC 27597. Tel. (919) 269-4406. Talk-in on 04/64.

SOUTHINGTON, CT The 10th annual Fleamarket of the Southington ARA will be held at Southington High School from 9AM-1 PM. Set-up at 7 AM. For details contact Steve N1GCV, (203) 621-6191. Talk-in on 146.88, 224.80, 444.25, 145.49. Pre-register for VE Exams by sending an SASE to Southington ARA, P.O. Box 873, Southington CT 06489.

APR 10

CLINTON, TN Oak Ridge ARC will hold

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check Events.TXT in Special Events File Area #11 on our BBS (603-924-9343). For listings that were too late to get into publication.

the "Oak Ridge Hamfest '93" at the National Guard Armory in Clinton, from 8 AM-5 PM. ARRL sanctioned. Talk-in on 146.88, 146.97 (W4SKH). VE Exams by WCARS; contact Ray Adams N4BAQ, 4325 Felly Dr., Knoxville TN 37918. Hamfest contact: Gene Muncy KB4UMM, (615) 435-1588.

FERGUS FALLS, MN The 6th annual ARRL Affiliated Hamfest sponsored by the Lake Region AC, will be held from 8 AM-3 PM at the Hockey Arena, Otter Tail County Fairgrounds, VE Exams. Set-up at 4 PM on Friday. Contact Keith McKay N0FKF, (218) 826-6274.

JOHNSON CITY, TN WCARS/VEC Exams will be held at 10 AM in Room 223, Technology Bldg., ETSU. Contact Charles Hensley AC4QF, (615) 743-5144 or (615) 926-1171 x7807; or C.V. Jayne, Jr. W4NHT, (615) 282-5822.

MARION, NC VEC Exams by the West Carolina ARS, will be held at 2 PM at the Asheville Federal Bank Bldg., Main St. Please call Cecil D. Potter WB4UCF, (704) 724-4007, for details.

MARYVILLE, TN The West Carolina ARS will offer VE Exams at 7 PM at St. Andrews Church Hall, W. Broadway. Please contact Carroll Peabody W4PCA, (615) 982-5839.

MEMPHIS, TN VE Exams will be held at 9 AM at Central Church, 6655 Winchester Rd. Sponsored by WCARS. Please call

Win Guin W2GLJ, (901) 754-4552, or Nita Wofford N4DON, (901) 363-4971.

ROANE COUNTY, TN VE Exams sponsored by WCARS, will be held at 10 AM at Pond Grove School, Rockwood. Contact Richard Spillee AA4KS, (615) 354-4281, or Bill Smelcer KA4AAD, (615) 882-9070.

SOUTHINGTON, CT The Southington ARA will hold its 10th annual Fleamarket at Southington High School from 9 AM-1 PM, at the Southington High School. Set-up at 7 AM. Talk-in on 146.88, 224.80, 444.25, 145.49. Contact Steve N1GCV, (203) 621-6191. VE Exams by pre-registration only; send a SASE to Southington ARA, P.O. Box 873, Southington CT 06489.

WEST MEMPHIS, AK WCARS VE Exams will be held at 9 AM at Rosewood United Methodist Church, 2303 E. Barton Ave. Contact Gene Bagley AB5BL, (501) 739-4029, or Rev. Richard Gregory AB5CH, (501) 735-4060.

APR 11

JASPER, TN West Carolina ARS VEC Exams will be conducted in the Jasper Public Library at 1 PM. Please call Charles Wooten KD4XX, (615) 942-5116, or Wallace S. Brown KD4XV, (615) 942-2836.

APR 15

FENTRESS COUNTY, TN VE Exams by

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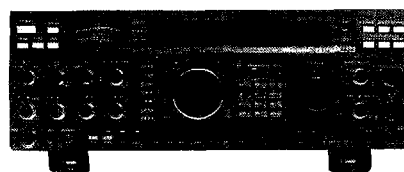


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the West Carolina ARS will be held at 7 PM at the First Baptist Church. Call Mike Ledbetter AB4BX, (615) 879-8626, or Fred Davis K8DOC, (615) 879-9268 for details.

APR 17

BOWLING GREEN, KY The National Guard Armory on Hwy. 231, near the Green River Pkwy., will be the location for a Hamfest/Computer Fest sponsored by the Kentucky Colonels ARC, from 7 AM-2 PM. Talk-in on 146.25/85 rpt. Call Denver, (502) 777-3681, or write: P.O. Box 9781, Bowling Green KY 42102.

COLUMBIA, SC The West Carolina ARS will offer VEC Exams at the Red Cross Bldg., Bull St., starting at 8:30 AM. For details, call Ray Rogers N4WR, (803) 345-3373.

GOOCHLAND, VA The S.M.A.R.T. Swapfest will be held at the Goochland County Fairgrounds beginning at 8 AM. Set-up at 6 AM. VE Exams at 12 noon. Talk-in on 147.27 and 444.800. Contact Wanda Clemons KD4OCK, (804) 556-4392.

JOPLIN, MO Joplin ARC Hamfest '93 will be held from 8 AM-3 PM at the John Q. Hammons Trade Center, NE corner of Hwy. 71 and I-44. VE Exams. Talk-in on 147.210+. Call (417) 623-3610, days, or (417) 782-5848 eves; or write to J.A.R.C., P.O. Box 2983, Joplin MO 64803.

KNOXVILLE, TN VE Exams for upgrades only will be held at Pellissippi State Tech. Comm. College, Room B-129 (formerly STIK, Pellissippi Campus). Sponsored by West Carolina ARS. Contact Ray Adams N4BAQ, (615) 688-7771, or Rich Slover ND4F, (615) 539-4821.

MEMPHIS, TN The WCARS will sponsor

VE Exams at Central Church, 6655 Winchester Rd., at 9 AM. Please call Win Guin W2GLJ, (901) 754-4552, or Nita Wofford N4DON, (901) 363-4971 for details.

NEW ALBANY, IN WCARS/VE Exams will be held in Room 204 at Knob View Bldg., Indiana University South, Grant Line Rd., from 10 AM to 2 PM. Please contact Dick Truax K8GVU, (812) 246-6377, or 'Mac' McCrory NM9A, (812) 944-6661.

SYLACAUGA, AL The Talladega RAC 2nd Annual Old Fashioned Hamfest will be held at B.B. Comer Memorial School from 8 AM-4 PM. VE Exams. Friday night Set-up 5 PM-8 PM. For details, call Jim Green KD4BHH, (205) 245-7825. Talk-in on 145.270.

APR 18

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club, will hold a Flea Market from 9 AM-2 PM at Albany and Main Sts. Set-up at 7 AM. Talk-in on 146.52 and 449.725/444.725 - pl 2A (W1XM rpt.). For info call (617) 253-3776.

OMAHA, NE The Ak-Sar-Ben ARC, Inc., will hold their annual Auction at the Millard Social Hall, I-80 and Hwy. 50 at exit 440 (about 1/4 mile south of the interchange on Hwy. 50). Buyer and seller registration begins at 7:30 AM. The Auction starts at 9:30 AM. Talk-in on 146.34/94 (W0EQU rpt.). Contact Ken Noel AJ0A, (402) 592-2338 after 6 PM - PBBS: 145.01 AJ0A @ K0BOY.NE; or Todd LeMense N0PHF, (402) 397-7465 after 6 PM PBBS: 145.01 N0PHF @ K0BOY.NE.

ROCKFORD, IL A Hamfest/Computer Show, sponsored by the Rockford ARC,

will be held at Rockford Metro Centre from 8 AM-4 PM. VE Exams. Talk-in on 146.01/61. For info, call Joe N9HEZ, (815) 399-6995.

SULLIVAN, IL The Moultrie Amateur Radio Klub (M.A.R.K.) will hold their 32nd annual Hamfest at the Moultrie County 4-H Fairgrounds on the Caldwell Rd., 5 miles east of Sullivan. VE Exams from 9 AM-12 Noon, by pre-registration only; contact M.A.R.K., P.O. Box 91, Lovington IL 61937. For Hamfest details, call Dave Duggins N9MPM, (217) 234-3283.

WAREHAM/BUZZARDS BAY, MA The Wareham ARC will hold a Hamfest from 10 AM-2 PM. Talk-in on 147.915/315 rpt., 146.52 simplex. For a flyer, send SASE to Barry Kennedy N1EZH, 24 Bungalow Ln., Buzzards Bay MA 02532.

WEBSTER, MA A Hamfest will be held by the Northeastern Conn. ARC, at the Point Breeze Restaurant, starting at 9 AM. Talk-in on 147.825/225, 146.52 simplex. Contact Chuck Weimer WB1AOC, 3 Plainview Dr., Danielson CT 06239. Tel. (203) 774-1723.

APR 23

KETTERING, OH The Southwest Ohio Chapter of the Quarter Century Wireless Assn. will hold its 1993 Annual Banquet the first evening of the Dayton Hamvention, at Neil's Heritage House, starting at 7:30. Reservations required. Gordon West WB6NOA will be the featured speaker. Contact Robert L. Dingle, Treas, Chapter 9, 1117 Big Hill Rd., Kettering OH 45429-1201.

APR 24

ASHEVILLE, NC WCARS/VEC Exams will be offered at the Health and Social

Services Bldg., at 9 AM. Please call Norman G. Hamill N4NH, (704) 253-1192, for details.

DALTON, GA WCARS VE Exams will be held at 3 PM at the Unity Baptist Church, Burleson Rd. Please contact Bert L. Coker, N4BZJ, (706) 259-5625, or Harold W. Jones N4OTC, (706) 673-2291.

MAY 1

CEDARBURG, WI The Ozaukee RC will sponsor its 15th Annual Cedarburg Swapfest, 8 AM-1 PM, at the Circle-B Recreation Center, Hwy. 60 and County I (20 miles north of Milwaukee, west of Grafton). Set-up at 6:30 AM. VE Exams at 9 AM. Talk-in on 146.37/97 and 146.52. Contact ORC Swapfest Chairman, 11448 Laguna Dr., Mequon WI 53092. Tel. (414) 242-4995.

FREDERICKSBURG, VA VE Exams will be held in the Rappahannock Library on May 1st. For details call AC4SK, (703) 373-7076, or AC4MB, (703) 891-5581.

GRAND JUNCTION, CO The Western Colorado ARC will hold its annual Hamfest in Liff Auditorium at Mesa State College, from 9 AM-2 PM. Seminars and VE Exams will be available. Talk-in on 146.94. Call (303) 242-6035 for info.

OWEGO, NY The Southern Tier Hamfest will be held by Southern Tier ARC at Marvin Park Fairgrounds, Rte. 17C and Exit 64, from 8 AM-4 PM. They will also sponsor their 34th annual Banquet. VE Exams. Talk-in on 146.16/76 or 146.52/52. Contact STARC, P.O. Box 7082, Endicott NY 13761-7082.

SOUTHEASTERN, VA The Hampton Roads Radio Assn. will sponsor W5YI Exams on May 1st. For details, contact Bill Runyon N4BDH, (804) 487-8611.

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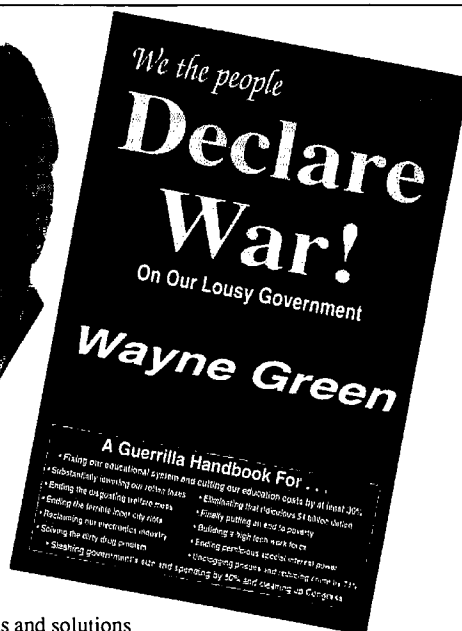
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MAY 1-2

ABILENE, TX The Key City ARC will sponsor the ARRL West Texas Section Convention and Hamfest at the Abilene Civic Center from 8 AM-5 PM Sat., and from 9 AM-3 PM Sun. VE Exams. Pre-registration must be received by April 27th. Talk-in on 146.160/760. Contact *Peg Richard KA4UPA*, 1442 Lakeside Dr., Abilene TX 79602. Tel. (915) 672-8889.

SIERRA VISTA, AZ The Cochise Area will hold its Annual Hamfest at the club training facility on Moson Rd. VE Exams. Contact *Robert Hollister N7INK*, (602) 378-3155 after 6 PM, or write to CARA, P.O. Box 1855, Sierra Vista AZ 85636-1855.

MAY 2

BEMIDJI, MN The Paul Bunyan ARC will hold its annual Hamfest from 8 AM-3:30 PM, at the Moose Club. Talk-in on 146.137.3. Flea Market. VE Exams. Contact *Robert Beyer, Hamfest Chairman*, P.O. Box 524, Bemidji MN 56601. Tel. (218) 751-4801.

YONKERS, NY A Giant Electronic Flea-market will be held at Lincoln High School, Kneeland Ave., from 9 AM-3 PM, by the METRO 70cm NETWORK. Indoor Flea Market. VE Exams. To register, call *Otto Supliski WB2SLO*, (914) 969-1053. Talk-in on 440.425 MHz PL 156.7; 223.760 MHz PL 67.0; 146.310 MHz; 443.350 MHz PL 156.7.

SPECIAL EVENT STATIONS

APR 24

BAY CITY, TX The Matagorda Co. ARC will operate N5QWF (or any other Matagorda Co. ARS) 0000Z-2400Z Apr. 2-4, in conjunction with the Bay City Her-

itage Day Festival. All bands in all modes. For QSL, send SASE to N5QWF, 4404 Doris St., Bay City TX 77414.

APR 3-4

GREEN VALLEY, AZ The Green Valley ARC will operate KC7MF 1600Z Apr. 3-2300Z Apr. 4, to commemorate the closing of all Titan Missile sites in the USA. Phone - 14,250, 21,330, 28,360 MHz. CW - in the Novice portion of the 10m band, around 28.150 MHz. For a certificate, send QSL and SASE to GVARC, 601 N. La Canada, Green Valley AZ 85614.

APR 12

HALIFAX, NC The Roanoke Valley ARS will operate KO4KP, 1400Z-2400Z, during the Halifax Resolves celebration commemorating our nation's first written request for independence. Operation will be in the General subbands and 10m Novice. For QSL, send QSL and SASE to *Terry Cieszki*, Rt. 2 Box 519B Zoo Rd., Roanoke Rapids NC 27870.

APR 17

CONSTITUTION ISLAND, NY The West Point Cadet ARC, in conjunction with the Orange County ARC, will operate W2KGY from the historical landmark "Constitution Island," from 1400Z-2000Z. Operation will be on 10 thru 80 in the first 10 kc of the General phone portion. QSL with SASE to SE Station W2KGY, Cadet AR Seminar, M Morgida, Dept. of EE and CS, USMA, West Point NY 10996.

SEATTLE, WA The NorthWest QRP Club will sponsor the First North West QRP Club Contest from 1700 UTC-2100 UTC on 7035-7040 kHz and 14060 kHz. For details, please contact *Bob Farnworth*

WU7F, Contest Editor NWQRP Club, Bellevue WA 98006.

APR 17-18

1993 CONNECTICUT QSO PARTY Operation will be 2000Z Apr. 17-2000Z Apr. 18, with a rest period 0400Z-1200Z. Phone and CW. Sponsored by the Candlewood ARA. For details, write to CARA, P.O. Box 3441, Danbury CT 06813-3441.

APR 23-24

THOMASVILLE, GA The Thomasville ARC will operate W4UCJ 1600Z-2400Z Apr. 23rd, and 1300Z-2200Z Apr. 24th, to commemorate the 72nd Annual Rose Festival. Operation will be in the lower General portion of the 80, 40, 20, and 15m phone or CW subbands, and the Novice 10m phone band. For a certificate, please send QSL and SASE to *Thomasville ARC*, P.O. Box 251, Thomasville GA 31799.

APR 24

SNOWFLAKE, AZ The Pleasant Valley ARC will operate KB7PIY from 1500Z-2300Z, to commemorate Astronomy Week. Operation will be on the 10m Novice phone band. For astrophotocertificate, send QSL and 9 x 12 SASE (2 postage units) to *A.R.S. KB7PIY, Bill Wood*, 14246 N. Westminster Pl., Fountain Hills AZ 85268-2706.

APR 24-25

LAFAYETTE, LA The Acadiana ARA will operate W5DDL from 1300Z-0200Z Apr. 24-25, to celebrate Festival International Delouisiane. Operation will be in the lower portion of the General 40, 20, and 15m phone bands, and the lower portion of the Novice 10m phone subband. Send QSL

and SASE to *Acadiana AR Assn. Inc., E. Miller*, 612 Harding, Lafayette LA 70503, or c/o P.O. Box 51174, Lafayette LA 70505-1174.

APR 25

OGDENSBURG, NY The Ogdensburg ARC will operate N2MXR 1400Z-2100Z, to commemorate the 125th Anniversary of the City of Ogdensburg. Operation will include 7.280, 14.325, 21.325, and the Novice portion of 10m +/- QRM. For an official certificate, send QSL with contact # and either a #10 or a 9 x 12 SASE to *Pete Baltradis*, RD 1 BOX 206, Norwood NY 13668.

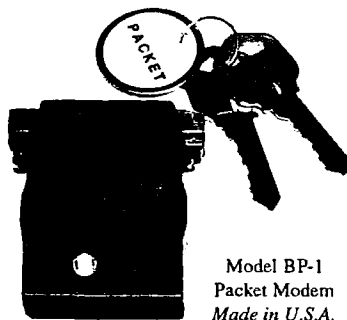
MAY 1-2

PHILADELPHIA, PA Station WA3BAT will be operated from 1300Z May 1st-2000Z May 2nd, by the Olympia ARC, to commemorate the 95th anniversary of Admiral Dewey's triumph over the Spanish fleet at the Battle of Manila Bay. SSB/Phone - 3.895, 7.245, 14.245, 21.265, 28.365, and 145.270. For a certificate, send QSL and a 9 x 12 SASE to *Olympia ARC*, P.O. Box 928, Philadelphia PA 19128.

MAY 3-JUN 3

HASTINGS, NEW ZEALAND Due to its past popularity, the 160m "Have A Go" Activity has been re-activated. This will be run during the NZART Field Day Contest, but will not be a part of it. This activity will be held from 2000 hrs NZT May 3rd-0300 hrs NZT June 3rd, LSB or CW, primarily at 1840 kHz (but anywhere in the band). Contact *David Walker ZL3DK*, 36 Ardrossan Ave., Flaxmere, Hastings, New Zealand.

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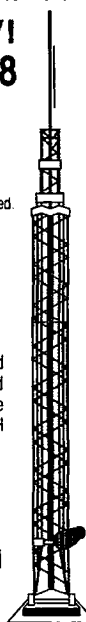
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RTTY LOOP

Continued from page 55

don't advise it. It is hard to match the convenience and stability of a commercial rig for these frequencies, and who says you have to buy new? Ask around at a local club, check hamfests, network through friends and local radio stores. If you keep your eyes open, I suspect you will be able to pick up a secondhand, slightly older, 2 meter radio for well within your budget. Who knows, someone reading this might just offer to help.

Getting on Packet

Matthew's second question revolves around packet. He says that, "while perusing the ads in the magazines, I read an article or two about packet radio. I've heard that packets are relayed all across the country. How does this work? I assume I broadcast the message and a local repeater will pass it along. How do I get started in this? It sounds a whole lot cheaper than calling long-distance!"

Well, before we get to the first part of the question, let's deal with the end. Don't forget that no matter what, ham radio is non-commercial communication that cannot be used to replace commercial carriers. So, unless your father is a ham, better stay with the phone company, or at least one of them.

Now, packet communication involves bundling little packets of digital

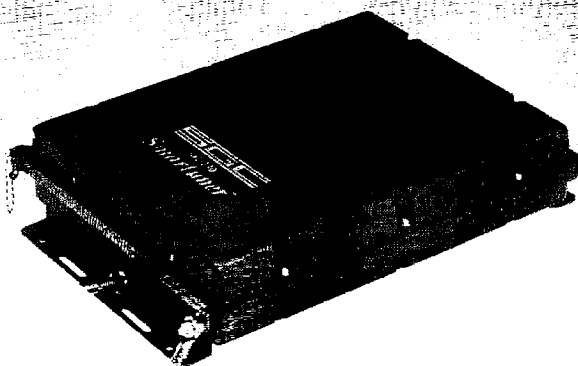
communications together, each packet of which is addressed to where it should go. You send these packets to either the addressee or another station which can relay it along. That relay station, an automated update of the old message relay system which founded a radio relay league, is a digipeater. Don't confuse this with a conventional VHF repeater. Whereas the repeater merely retransmits the received audio on another frequency, the digipeater regenerates the received data, thus cleaning up the data. More on this in future columns.

Digital communications span the spectrum from old-fashioned radioteletype to the latest computer wizardry, and "RTTY Loop" loops around the same neighborhood. For example, volumes one and two of the PC compatible RTTY programs remain available, as is a collection of PC archiving utilities. Each collection is over a megabyte in size, and will fit on a high density 5" or 3.5" disk, or on a bunch of low capacity ones. To receive your copies, send me sufficient media, a postage-paid return disk mailer, two dollars in US funds per disk, and be sure to tell me which collection you want. Send it all to me at the above address, and I'll turn it around real soon. Don't forget to send me your comments and questions as well; to the address above, or via CompuServe (ppn 75036.2501), Delphi (username MarcWA3AJR), or America Online (screen name MarcWA3AJR).

23

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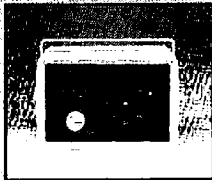
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ABOVE & BEYOND

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Collecting Surplus Surface Mount Components

This month we'll cover one method to help you stock your junk box with some exotic components. Normally, the removal of the miniature components presents a large problem when undertaken in mass, but I think you will be quite pleasantly surprised to find out how well this method works.

First, a little about the components that can be reclaimed. Surface mount components, being very small, make new construction respectably smaller than conventional circuits.

A quick example is a standard IC. Take any basic device and you will find that it is available not only in the standard 14- or 16-pin plastic package that we are all familiar with, but most come in surface mount packages as well. The main difference is size. The standard 14-pin IC is just over an inch long, with pin-to-pin spacing of 0.1". The surface mount equivalent is less than half the length and about one quarter the height. See Figure 1 for the size comparison.

ICs are not the only components that come in these miniature packages. Resistors, capacitors, inductors, transistors and a lot more are coming packaged this way. In fact, I just found in surplus several mixers for RF that work over their range of 5 MHz to 2000 MHz. A lot of exotic surface mount components are being used in electronic equipment manufacture due to size constraints. This should make more of the older surface mount systems available in the surplus or scrap market for amateur use. Be observant and you might locate a gold mine in surplus components in your local area.

One problem that has hung on with these packages getting smaller and

smaller is repairing or modifying circuits. Most people have difficulty removing a chip capacitor as it is very small and must be desoldered on both ends to remove it from a PC board. Why are surplus surface mount components so attractive when you can't easily unsolder them with a soldering iron? Because you don't use a soldering iron. What you want to do is advance into the 21st century in your soldering techniques. I don't propose that you go out and purchase a \$1,000 soldering station. No, what you want to do is to spend about \$20 and be able to have some of the best methods of soldering (or, in our case, unsoldering) at your fingertips. What device can you purchase for \$20? A heat gun. This device is normally used for removing paint by the blistering method, then the blistered paint is scraped off. In our application you will use this same heat gun for electronic component unsoldering, or shrink tubing applications.

D-text: The heat gun has limitations, but as long as you know that soft plastic IC sockets and similar devices will be affected by the gun's intense heat (melted) it will be no problem. Sockets and such can be removed with care, as can some soft plastic components, but I don't see much advantage to keeping them. I find that I want the ICs and electrolytes as well as the tantalums in preference to plastic mounting hardware. I don't bother with resistors, although they come loose free for the ride. These heat guns are capable of blowing a hot 700 to 800 degree blast of air in a stream quite similar to a hair dryer. This will heat up the solder in about two minutes of air flowing about the solder junctions in the air stream.

Before using a heat gun to strip a PC board of components you can use a soldering iron and an X-Acto™ knife or some other means to gently lift each lead of delicate components. When you start to unsolder a PC

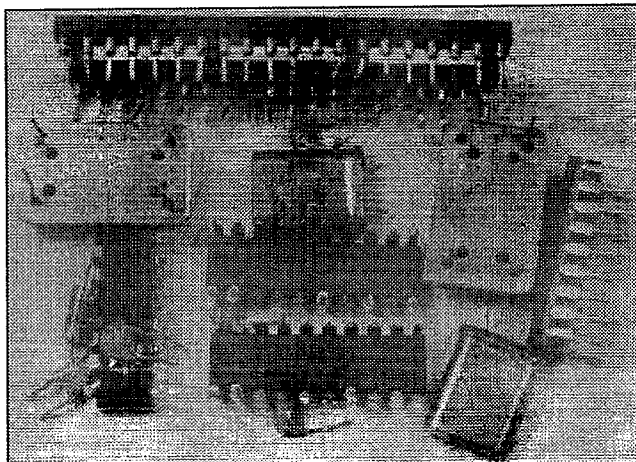


Photo A. Components removed with a heat gun. Note the clean pins, even on a 40-pin socket removed from a 386-25 PC board. The 20-pin chips under the 16 MHz crystal show dirty solder leads. These chips were pulled too soon—not all of the solder was allowed to flow before the chip was pulled.

board, direct the heat gun's nozzle to an area on the backside of a PC board to remove conventional chip components first. In some cases you might just have to tap the board to jostle loose surface mount components, letting them drop to a paper below for collection.

In using a heat gun, apply the exhaust (much like a hair dryer, only much hotter) to the PC board area to be heated and position the gun about half an inch from the surface of the board. Don't get too close as this will only burn the PC board. A half inch to an inch is about right. You will have to do a little experimenting with this technique and I suggest a scrap of PC board to try for a first attempt. I have found that positioning the PC board securely in a bench or drill vice will allow you to work rapidly on it. Position the board vertically for conventional rear-soldered PC boards and horizontally for surface mount boards. This leaves both hands free—one for the heat gun and the other for tapping or gently removing components with an X-Acto knife.

Bring the solder to molten temperature around the components to be removed. It will be very apparent as some of them will squirm about their solder pads. This takes about two minutes for the initial heat application. After that, the nearby components take a much shorter time to detach from the board. Some of the ICs can be removed with forceps by gentle lifting (that is, assuming that the component leads were not bent when they were originally inserted on the PC board).

This process sounds unbelievable but in actual practice it works quite well. Last night I unsoldered a PC board to recover some connectors and ICs from a defective 386-25 MHz computer motherboard. I completed removing all the components from the board in about 10 minutes. The board was empty of all chips that were soldered, leaving just the sockets and a

few of the other components. Bypass capacitors, clock oscillators, 40-pin sockets, etc., were all removed in this operation with the heat gun.

The procedure to use with surface mount components is much the same, but instead of directing the heat to the rear of the board, direct it to the component side where the surface mount part is attached. This works well to remove top-mount components on the PC board. When a heat gun is used components retain their exact form and are not distorted in the removal process. If a conventional soldering iron (pencil type) is used to remove a four-leaded transistor, the leads each have to be heated and lifted with a knife. When this operation is completed, the part is removed but all four leads have been bent or otherwise deformed in the process and sometimes are quite resistant to being removed intact. With the heat gun, the only possible damage that can be subjected to the part is excessive heat. Most devices take the operation with the heat gun well. Just use reason and common sense. In no case should the PC board burn or blister or smoke—if it does you're too close and there's too much heat. Back off and give it a little time. Don't try to rush here.

Don't rush the solder during its heating. The part can be pulled off prematurely, but if you wait a short time it will come off quite clean without effort. For instance, when removing a 14-pin or even a 40-pin chip, heat the board from the solder side for about two minutes to bring the section of board to temperature and watch the solder on the opposite side of the board. It will soon show signs of being molten. Don't pull the IC or socket just yet, even if it seems to come with a little pressure. If you wait another 15 seconds or so it will pull off without pressure and the board will wick off the excess solder from the part, making the pins on the IC clean. You will not have to clean up the part later if you take time in this step.

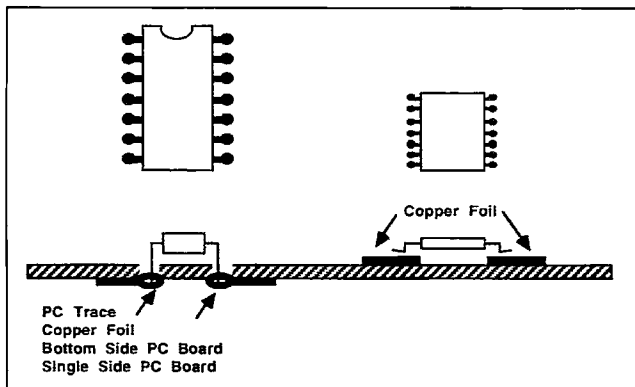


Figure 1. Standard 14-pin DIP, compared to a surface mount IC. The 14-pin DIP mounts through holes drilled in the PC board. Surface mount means just that—it is soldered on the component side of the PC board (no holes).

I suggest you invest in a similar unit that can be picked up in a well-stocked hardware store. On the West Coast they can be obtained in the "Home Depot" and "Home Club" type home handyman stores. You should not have trouble finding a similar heat gun as this type of store sells just about everything, including the kitchen sink. I checked with Sears and they have two models of heat gun to chose from. The first is a Wagner Model 15115, which heats to 850 degrees, priced at \$24.99. The second is a variable heat control type, also from Wagner, with heat to 1100 degrees, priced at \$29.99.

I have not tried either of these two models from Sears, but they are quite similar to the unit I picked up from a local hardware store. My heat gun is dual-heat, stating low heat of 700 degrees and high heat of about 1500 degrees. It's called a "Super Stripper Mod. 1500" and is made in Taiwan. I don't think the upper temperature is actually reached; I have no way to measure its temperature output. Needless to say, a good AC power connection is required as these heat guns draw quite a few amps to do their job efficiently. Extension cords should not be used as they may limit output. Some more common extension cords are constructed from small diameter conductors and can't support the higher currents needed by the heat gun.

Mailbox Comments

Oscar Franco LU7ATH, from Argentina, recently corresponded with me and is working on setting up some YIG oscillators for the microwave bands below 5 GHz. I sent him a PC board for the 5.6 GHz band to assist his operation. I also sent a few SRA-11 mixers that are good to 2000 MHz RF. I hope these assist him in construction projects in Argentina.

The biggest problem in shipping components to others is the distance and assurance that the components do arrive. Air shipment and insurance can be quite costly. For us here, it's all too easy to hop in the car and go to our local parts supplier. We should all take another look and be quite thankful that we have the opportunity and good fortune to have electronic super-markets, or even a Radio Shack, from which to pick up simple parts. They are so easy that we forget what it's like in other parts of the world.

Another traveler I have communicated with is Thad N2QMG. Thad's current project is a 10 GHz wideband FM transceiver and CW IDer. I have to redesign the PC board for the IDer to make it more compact and use fewer jumpers, but that is just a matter of time on my part. There's always a new PC board to design.

Jean-Yves Trudie VE2BFU is chair of a group of students in Quebec who are quite interested in weather applications of radar. He is looking for any

inexpensive components to help out on projects. He refers to the column on the 10 GHz amplifier in the September 1992 issue of 73. He questions, can it be driven from a low power Gunn oscillator? Well, the answer is yes. I use a simple 10 mW Gunn oscillator and 30 dB attenuation on my work bench to replace all other systems in amplifier testing. When used in conjunction with the variable 30 dB waveguide attenuator, it can be preset to some low level to test other devices. I use it to provide power (RF drive) to test traveling wave amplifiers on 10 GHz.

TWTs require about +1 dBm to drive to full amplification of 10 watts output. The Gunn oscillator works very well in this application. It can be used in conjunction with a solid-state amplifier just as well. However, I must stress the output attenuator as it is a must in all applications. Don't ever overdrive amplifiers as it could result in destruction of your test device, depending on the power level used. See Figure 1, my test 10 GHz Gunn oscillator. The only drawback with a Gunn oscillator is frequency instability, but as a power driving source they work exceedingly well and are inexpensive.

A letter from Hugh Duff VE3OYH requests permission to use the amplifier schematic I published in the September 1989 issue of 73 magazine. It concerned an SSB biasing scheme and power amplifier schemat-

ic for a 6 meter amp I constructed for my IC-551. The design was not special. It used application notes that were available from transistor manufacturing companies at that time. What I did was try the circuit (class C) and modify it to an SSB class of circuit for linear operation—kind of a class A/B type of operation. In class C no DC power is drawn from the device until driven by RF. In class B's and later class A's, some current is drawn without RF drive to set up the stage towards linear operation.


Also, Hugh is looking for some of the FM accessory boards for the IC-551. Any help out there on the PC boards? Contact Hugh Duff VE3OYH, 136 Baronwood Crt., Brampton, Ontario, Canada L6V-3H8.

Steve Carlisle VE7AHL writes that he has obtained some microwave waveguide material for 10 GHz and would be willing to make some available for interested parties. Steve is located in Port Hardy, B.C., Canada, and can be contacted at (604) 949-8588 (after 6 p.m. PST). The material he has includes 12-foot sections of WG-16 (1/2" by 1" o.d.) and a variety of bends and straight sections. Detector mounts and hybrids are also available. Contact Steve for particulars.

Well, that's it for this month. As always, I will be glad to answer questions regarding this and other related subjects. Please send an SASE for prompt reply. 73 Chuck WB6IGP

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

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Notes from FN42

Reward time is here again! What am I talking about? The rewards we receive when we help others become hams. Also rewarding is seeing those we helped become hams last year volunteer to help in this year's classes.

How easy (or hard) is it to host a ham class? I can only speak for myself, but I don't think that it is too hard if one person will provide the coordination and many others get involved and help teach the lessons. What it takes is having the vision to make it happen, letting others know about that vision, and talking it up to those who are active hams.

Luckily, the effort in the Keene, New Hampshire, area really started last year after completing the previous ham class and examinations. All those involved last year said that they wanted to do it again. It was decided to continue to offer the classes once each year. We decided that the classes worked best during the school year, preferably between January and June, so we set a tentative start date in February.

Around December, discussion of the ham classes started to flow on the radio and over coffee. Those of us who helped teach the classes last year asked Doug KD1GJ if he would lead the effort again this year, and he agreed. Off to a good beginning.

January arrives. Meeting time

again, this time to decide when to start the sessions and who was going to teach which modules. Before we decided on a date, Doug announced that a new ham club in the area, the Cheshire County DX Amateur Radio Club, was willing to sponsor the effort. It is certainly nice to have the support of a larger group of hams.

The decision was made to offer the classes one evening a week and to go for 10 weeks, with the test in the 11th week. Each class would last for approximately 2-1/2 hours, with a break, and cover three to four modules. Doug, organized as usual, brought the syllabus from last year, and then it was time to select modules to teach. That really took very little time because just about all the modules (with a few exceptions) would be taught by the person who taught it last year.

We are very lucky that one of the largest employers in Keene, Markem Corporation, is also very appreciative of the hams within its organization and is allowing us to hold the classes in its facilities. Markem is also allowing VE testing at the same location four times each year.

February 15th is just several weeks away as I write this column. Lesson plans are being put together by the instructors and hands-on demonstrations are being developed. The old excitement is coming back and starting to bubble to the surface. If you have never felt that excitement, try it, you'll like it!

Well, I'll let you know in the future how things work out, but I bet they will turn out great.

Lastly, I hope that you enjoy the two QSL cards from Japan. There is something about the artistry and colors from Japan that set their pictures and architecture apart from the rest of the world. I am very lucky that David sent two of his QSL cards because one of them is going to stay here on my wall. Now I just have to find him on the air to really deserve it.

Until next month.
73—Amie, N1BAC

Roundup

Pakistan It is with great happiness that the Larkana Amateur & SW Listeners Club celebrated its 2nd anniversary on 6 Nov. 1992.

We invited many people to celebrate with us, including two



Photo A. A few members of the Larkana Amateur & SW Listeners Club.

Canadian hams, Mr. Rod Black and Mr. Mark Naylor, who are now working in Pakistan with a Christian mission. Mr. Black briefly informed the audience about the fantastic hobby of ham radio and donated some books to our club. After the program was over, 20 interested people filled out the membership forms of the club. We have about 50 books about electronics and amateur radio in our library.

Our radio equipment presently consists of a Drake TRM-34 (100 watts) SSB Marine transceiver that operates on the 2, 4, and 8 MHz bands. Does anyone know if this radio can be converted to the ham bands, or would anyone like to exchange this radio for an SSB QRP transceiver? The radio would have to have the 20 meter band. We also have a vintage Radio Holland Type BC 348JW communication receiver with frequency coverage of 200 kHz to 18 MHz in six bands. We are interested in trading this radio as well for an SSB QRP radio. As you can see, we have no radios to get on the air because of the great expense, so we would definitely appreciate anything that you might have that you could donate to us or trade with us.

Please communicate with us at this address: Arshad H. Quadri (AP2AHQ), Larkana Amateur & SW Listeners Club, No 1989/A 1, Shaikh Street, Karma Bagh Larkana, 77150, (Sindh) Pakistan.

Russia Downloaded from packet, initiated by Sandy Lynch WA6BXH: The following message was recently received here from Andy RW3AH/WL7AP. I think he and Ed NT2X wrote it together; the info may be of interest to others. 73 de Sandy WA6BXH/7J1ABV [WA6BXH @ N0ARY].

Ham Radio in CIS Becoming Expensive There are serious troubles looming on the horizon for the amateurs of the former USSR. Obsessed with "market economy," people in charge of Amateur Radio Service on the government level have imposed (or will impose very soon) substantial fees for the privilege of operating on the air.

The First Class license (equivalent of the US Extra) will cost a ham 120 rubles per annum. To enter any contests, one would fork over 240 rubles per year, in addition to the above. It won't matter if you run 100 watts or 10

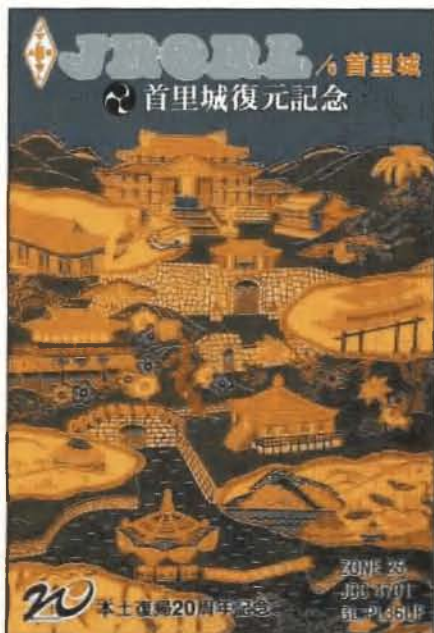


Photo B. QSL card of JR6RL.



Photo C. The beautiful QSL card of 7J6CBQ, David Cowhig, Ambassador to Okinawa, Japan.

kW. Special calls call for yet more money. In US currency this doesn't look like much (\$1 = 500 rubles), but it sets a dangerous pattern—pay for what once was free, and expect an increase anytime. The opinions of hams ops were never requested, it seems.

In addition, getting a contest certificate via the bureau would cost five rubles, receiving a single card via the bureau now costs 50 kopecks, sending a single card abroad via the bureau would cost two rubles 15 kopecks. An airmail letter from Russia to anywhere in the world now costs 75 rubles.

Since the prevailing majority of hams can't afford to send airmail letters (the average salary now stands at three to four thousands rubles per month) in quantity, and because the foreign mail isn't getting through to Russia, those U-cards will become very rare indeed very soon. Moscow hams report piles upon piles of incoming QSLs at Box 88 that don't and won't get processed. The bureau is broke and can't pay its employees or its own mailing expenses. Again, hold onto your CIS cards, don't mail them over there until the situation is resolved.

On the related subject: January 1993 was set as a time frame for the changeover of current amateur call-sign allocations to a new system.

Ninety-five percent of all Ukrainian calls will change as well as a substantial amount of Russian calls, if the new system is implemented. Other republics will see a full 100% change of existing calls. As was announced earlier, the new allocations were assigned without any consultations with hams, thus the amateur community of the former USSR republics is in a state of turmoil. Nobody knows what will take place, when and how.

Letters were sent to the ITU, trying to stop the new assignment; government offices responsible for communications were petitioned without any obvious results. There is talk about having hams retain the present call-sign system, while commercial and utility calls would be converted. At this time, it is all pure speculation and no decisions on this explosive topic were rendered. There would be no special calls assigned within the CIS for 1993, I was told, pending the outcome of the above.

As always, we will provide more details as they become available.

73 de Andy RW3AH/WL7AP, 19 Jan. 1993, RW3AH @ RK3KP#MSK. RUS.EU

Switzerland *From the International Telecommunication Union (ITU) Press:* The ITU has issued the first series of telecommunication indicators covering all republics of the former

Soviet Union: Commonwealth of Independent States (CIS), the Baltic States, and the Republic of Georgia.

A joint collaboration of the ITU's Telecommunications Development Bureau and the OECD Centre for Co-Operation with the European Economies in Transition, Telecommunication Indicators of the Former Soviet Union highlights the current state of telecommunications in the region. It has over 30 tables and charts and includes regional totals and averages.

An analysis of the data shows that the telecommunication sector has been characterized by under-investment over a long period, resulting in an urgent need for network modernization to meet the requirements of the population and the emerging market economies.

The supply of telecommunication services also varies greatly from one republic to another, with an average of main telephone lines per 100 inhabitants for the former Soviet Union of 14 (Baltic states average over 20, the Central Asian republics less than 10, and Belarus, Ukraine, and the Russian Federation close to the average).

Highlights of the statistical compilations include: an official waiting list of over 18 million lines (about half the number of existing subscribers, which probably underestimates the total demand); automatic local networks but

with low levels of digitization and old exchanges; an estimated investment of US\$90 billion to attain a telephone density of 30 main lines per 100 inhabitants by the year 2005, requiring the installation of 60 million main lines; an average level of telecommunications development about the same as Central and Eastern Europe and similar to the situation in Western Europe in the 1970s.

The data is available both in hard copy and diskette formats with STARS (Socioeconomic Time Series Access and Retrieval System)—a user-friendly retrieval software for use with microcomputers. For more information and permission to reproduce any part of the publication, please contact: Mr. Michael Mingos, Information Services/Telecommunications Development Bureau, International Telecommunication Union, Place des Nations, CH-1211 Geneva 20, Switzerland. Telephone: +41 22 730 5519; FAX: +41 22 730 5484.

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CIRCLE 131 ON READER SERVICE CARD

sador Armin Meyer W3ACE, who served as US Ambassador to Japan 1970-1973. Ambassador Meyer told me once that his security guards were very alarmed one day in the early '70s in Tokyo when his car was rushed by a group of Japanese men. When they got close to the car the men began waving their QSL cards at Ambassador Meyer! Perhaps it was Ambassador Meyer's high-level ham enthusiasm that inspired the Japan-US reciprocal licensing agreement which came a few years later.

December in Okinawa, as in the rest of Japan, brings forget-the-old-year parties (bonenkai) for office workers and hams alike. During December I went to bonenkais of the southern Okinawa 145.19 MHz foxhunting group and of the central Okinawa 2 meter FM group. A week later Yamamoto-san JS6HGV of the foxhunting group took me on a two-hour foxhunt all over Urasoe City, ending with an impromptu meeting over coffee and cakes under the stars. Lots of fun even though Yamamoto-san and I were the last ones to find the fox!

Okinawa blended the cultures of south Asia, China and Japan to create its own unique culture. Awamori, a powerful Okinawan drink made famous by the Japanese actor Marlon Brando in "Teahouse of the August Moon," was brought back to Okinawa

500 years ago from Thailand by Ryukyu Kingdom sailors. Okinawan music and dance, which are quite distinct in beat and style from that of the rest of Japan, owes much to the instruments and music of Indonesia and India. After World War II the United States had some influence on Okinawa, introducing universal education, the first university (Ryukyu University) and root beer. Their very cosmopolitan history has made the Okinawans the friendliest and most internationally minded of all the Japanese. The Okinawans sum up their attitude in the Okinawan dialect phrase "ichariba chode," which can be translated as "aloha" or as "to be brothers from the first meeting."

A new historical novel about the 17th century Ryukyu Kingdom, *The Winds of the Ryukyus*, by Chin Shunshin, now an NHK TV series, has stimulated a tremendous revival of interest in Okinawan history and culture. Chinese goods acquired in exchanges with Ming China through the Ryukyu Kingdom tribute missions and Chinese embassies to the Ryukyu Kingdom capital at Shuri were used to trade throughout South Asia and Japan. Okinawans had a practical monopoly on the China trade since Ming China traded directly only with its loyal tributary state in Okinawa and Chinese merchants were forbidden to travel abroad. My QSL card, which I

am able to use thanks to the kind permission of the Urasoe City Museum of Art, shows tribute ships which carried Okinawan presents to the Ming Emperor.

On April 1, 1993, a new Japanese law charges user fees to all users of the radio spectrum. This is on top of the current fees which radio stations pay today. For example, my 50-watt fixed/mobile ham license costs about \$30 per year to renew. Even my 50 watts is high—most Japanese hams have third- or fourth-class licenses and run 10-25 watts. The initial license fee and renewal fee is on a sliding scale which increases with transmitter power output. Japanese hams will pay 500 yen (US \$4), while radio broadcasters will pay 29,700 yen (\$300) annually. This new Japanese law is intended to raise money to regulate licensed stations and to detect and close down unlawful radio stations. In 1990 there were an estimated seven million lawful radio stations and 1.2 million illegal radio stations operating in Japan. Another goal is to boost radio spectrum use efficiency.

Similar efforts to boost spectrum efficiency by user fees and other methods are also being considered by the US National Telecommunications and Information Administration (NTIA) and the US Congress. NTIA administrator Janice Obuchowski has com-

pared the sale of radio spectrum in order to improve spectrum utilization efficiency to the transfer of public grazing lands to private ownership in 17th and 18th century England, which economists credit with greatly boosting agricultural productivity. Today (January 3) Song BY5HZ, in Hangzhou, China, told me that the Chinese government has decided to allow Chinese hams to set up ham stations in their own homes. Song, a junior high school teacher, has held his own personal call sign BG5FA for about a year but beginning February 20, 1993, he will be allowed to operate a home station. Song told me that some of the first Chinese hams, such as BA1CY in Beijing, have been allowed to operate from a private home for about a year. Now this privilege is being extended to more recent licensees, such as Song. This is wonderful news for Chinese ham radio operators and for hams around the world. Perhaps many of the Chinese hams who couldn't get on the air after graduating from school will return to the air.

A reminder to all who wish to get a license when coming to Japan: The best way to get information is to write to the JARL International Section, 14-2 Sugamo 1-Chrome Toshima-Ku, Tokyo 170 Japan.

(David's contribution will be continued next month.—Arnie)

73

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CIRCLE 11 ON READER SERVICE CARD

Continued from page 66

My *Frontiers* publication was mainly

I was having so much fun that I stayed on as editor a couple years longer than I should have. But I've

I read a lot of magazines, so I have to be able to interpret computerese, legalese, governmentese, medicalese, hamese, hi-fi-ese, and educationese. It's a challenge to try and figure out what some professor is trying to say.

For my part, when I'm on the air I avoid jargon and stick to plain English. I have problems with interference, not QRM. I go to bed instead of modulating the mattress. I answer the phone instead of the landline. But then I am very resistant to talking about my transceiver and antenna, much preferring to talk about what the other chap does, what else he's interested in, what he likes about where he lives and so on. You probably wouldn't like it at all.

CIRCLE 54 ON READER SERVICE CARD

NEW PRODUCTS

Compiled by Hope Currier



C O M E T
Antenna has introduced the newest addition to their extensive line of multiband antennas, the CH-32 "Miracle Baby" Mini HT Antenna for 2m/70 cm. The CH-32 has surprising performance, is only 1.75 inches tall, and has a black matte

NCG/COMET

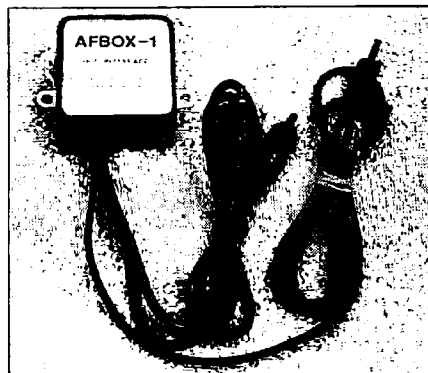
finish and a BNC connector. It is designed with a pivoting head, absorbing shock and protecting the radio's connector from damage. The CH-32 meets the modern operator's need for a small, compact antenna that easily works the nearby repeater systems and is useful for communicating at hamfests, on Field Day, while doing tower work, etc. Its small size makes it inconspicuous and proportionate in size to the newest HT transceivers.

For the price and more information, contact NCG, 1275 North Grove St., Anaheim CA 92806; (714) 630-4541, (800) 962-2611, Fax: (714) 630-7024. Or circle Reader Service No. 201.

ELECTRON PROCESSING

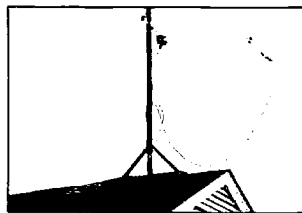
Electron Processing has announced a device to greatly improve scanner and shortwave reception. The AFBOX-1 allows you to connect your receiver to an existing hi-fi stereo system to extract the best fidelity and clearest sound obtainable from your scanner or shortwave receiver. By connecting to a stereo system scanner,

listeners can often understand previously unintelligible background conversations. Shortwave listeners can finally enjoy the full fidelity with which the broadcasts were meant to be heard. Connection to the external speaker jack of the receiver and the hi-fi auxiliary input jacks is easy with the supplied connectors. An isolation transformer and passive attenuator



assure clean, noise- and hum-free sound on both right and left channels. The AFBOX-1 can be connected to a VCR for up to six hours of quality recording.

The AFBOX-1 is \$30 plus \$5 S & H. For more information, contact Electron Processing, Inc., P.O. Box 68, Cedar MI 49621; (616) 228-7020. Or circle Reader Service No. 205.



G & P ENGINEERING

G & P Engineering has announced a new style of antenna mounting system called the "N-PAM" unit. The N-PAM unit will mount on the roof without drilling holes into the roof. It will mount on any roof at any pitch from flat to a

12/12 pitch, and will allow use on roofs with 16" o.c., 24" o.c., stick-built or truss systems. Basic systems include single or dual tray units with a 2" mast 3' high—ideal for a tribander/VHF-UHF system. Options include a 5' or 7' mast. The 7' mast can be used with the largest OSCAR antenna system or stacked yagis.

All mounts are made of steel and are primed and painted with a durable and hard epoxy paint, black, to blend with most roof shingle colors. For prices and more information, contact G & P Engineering, 4943 Finch Court, Stephens City VA 22655; (703) 869-4530, Fax: (703) 869-5116. Or circle Reader Service No. 204.

BackPack Solar?

10 watt DesertStorm panel is size of open 73 magazine, weighs 1lb, and delivers 600mA for 12v charging or direct operation. Tough. Solid, with no glass to break. So rugged Uncle Sam used this for spotter communications and portable repeaters in Desert Storm. Ready to use. \$169. Add \$5 S&H. Info \$1.



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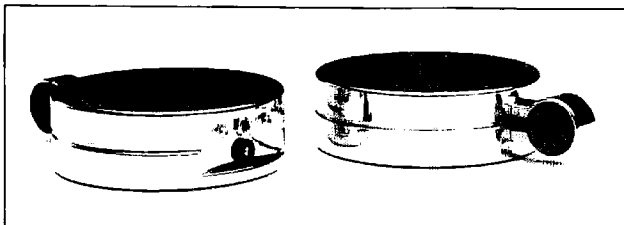
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CAL-AV LABS

CAL-AV Labs, Inc. has introduced the Spirit™ series of dual-paddle Morse keys, which incorporate advanced design and a new technology to eliminate contacts and all other moving parts. Designed for optimum performance in a traditional operating environment, the Spirit provides familiar functionality very similar to a mechanical key. Its solid-state-force sensors activate when a given, preset force is exceeded. Independent left and right adjustments have infinite resolution, and will accommodate operators with a light or heavy touch. The unit weighs five pounds and will not move

from its desired desktop location.

The Spirit is currently available as a limited-production edition for the discerning enthusiast. Its uncompromising quality is evident in its polished, solid brass construction. Each key is individually serialized and can be further customized to a user's preferences: engraving of an individual's name or call letters is available; chrome or gold plating are optional. Detachable cabling accommodates a wide variety of keyers. Prices start at \$380. For more information, contact CAL-AV Labs, Inc., 515-B Westchester Drive, Campbell CA 95008; (408) 369-1000. Or circle Reader Service No. 203.

LARSEN ANTENNAS

Larsen Electronics' new KG 1290 is the first on-glass antenna for amateur application on the 1290 MHz band. Engineered for ham use in North America and Japan, the unit covers the bandwidth from 1235 to 1432 MHz with a VSWR reading below 1.5 to 1. Using a collinear design featuring a 1/2 wave over 1/4 wave, the antenna produces 3 dBd gain. Exceptional performance stems from the patented Kulglass design that places the radiating antenna circuitry in the outside coupler (not inside the vehicle) to maximize efficiency. Model KG 1290 also features a Kulrod copper-plated whip which lets transmit power become signal, not heat resistance.

The suggested retail price is \$59.95. For more information, contact Larsen Antennas, Larsen Electronics, Inc., 3611 N.E. 112th Avenue, P.O. Box 1799, Vancouver WA 98668; (206) 944-7551, Fax: (206) 944-7556. Or circle Reader Service No. 202.



OAK HILLS RESEARCH

The QRP Spirit Transceiver from Oak Hills Research is a single-band kit offered for 80, 40, 30, 20 or 15 meters. It includes an iambic keyer using the latest Curtis Keyer Chip 8044ABM, a Superhet receiver design with a diode ring mixer and an RF preamp, a 4-pole crystal ladder filter followed by an on-board audio filter,

and a switchable HP AGC circuit with manual RF gain control. It also offers 2 watts of audio output with an external speaker jack, VFO tuning with an 8:1 vernier dial covering 100 kHz and RIT, and a sine wave oscillator with frequency and level controls. The kit measures 4" x 6-1/4" x 6-7/8" and weighs 47 oz.

This kit comes complete including the cabinet, all components and instructions. All coils are pre-wound. The price is \$198.95. For more information, contact Oak Hills Research, 20879 Madison St., Big Rapids MI 49307; (616) 796-0920, (800) 842-3748, Fax: (616) 796-6633. Or circle Reader Service No. 206.

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CIRCLE 193 ON READER SERVICE CARD

RANDOM OUTPUT

David Cassidy N1GPH

Is This Frequency In Use?

Is it me, or are people getting stupid? Allow me to relate to you what I experienced last weekend. The names and callsigns have been changed to protect the moronic.

I had been involved in a net on 7.283 MHz for close to an hour. It was a cold, gray Saturday morning, and I was enjoying the net and a second cup of coffee. We had check-ins from locations as far apart as Colorado, Georgia and Nova Scotia. Net control was located in Milwaukee, and he was running slightly more than 900 watts. Conditions on 40 meters were excellent and the band was packed.

A W1 station came on our exact frequency, and without a word of warning started calling a W2 station. His signal was S-9 +20 and just about wiped out the entire Northeast part of the country. I informed him that the frequency was in use, and asked him kindly to move. He never acknowledged that he heard me (knowing his location and my antenna's performance, I am 100% certain that he did).

After a minute or two, he made the same call, and I again asked him to move. Again, no reply. Two or three minutes later, the same scenario. By this time, stations in New York and Nova Scotia had also asked the W1 to move. They were met with the same results I had achieved—silence.

Another five minutes passed without a call. Right at the top of the hour, the W1 came on and started informally calling a net ("Anybody from the XYZ net on frequency?"). The W2 station he had originally called came back to him and they started an informal chat. At the first available break in their seemingly endless discussion about their signal strengths, I keyed up and again informed them that the frequency was in use by another net, and would they please move off frequency.

Now, here comes the really incredible part.

W1: Did you hear that?

W2: Yup, I heard something. I think he said there was another net on this frequency.

W1: Yeah, that's what I heard.

W2: If we move frequencies, the net will never find us. This is our frequency. We've been here for years. They must be a new net (the net I was checked into has been operating for many years at the same time and frequency, though I can't fathom what that has to do with anything).

W1: So, how's my signal now? I just changed over to the other antenna.

The two stations, after acknowledging that they had heard me and that they were aware that another QSO was in progress on the frequency, continued their conversation as if nothing had happened. I couldn't believe it! I again asked them to move, and again they acknowledged that they heard me—with the same results. I heard net control call me for my next transmission, but was wiped off of the net by these two lads. They finally said, "let's move up 500 hertz, to give them a little room." Can you believe it? These weren't a couple of newcomers. Judging from their callsigns, these two lads had each been hams for over 25 years, and yet they thought that moving 500 hertz would do anything? Did these guys know the first thing about radio?

Every area of human endeavor has a set of fundamental rules, guidelines or mutual agreements. All participants in the activity have agreed to abide by these rules. When you drive an automobile, you agree to be sober and to obey certain traffic signals. In this country, you agree to drive on the right side of the road. One of the fundamental agreements that we amateurs make with each other is that we will ask if a frequency is in use before transmitting. We have also agreed that no station or group of stations can lay claim to a particular frequency. This means that there will often be conflicts. When propagation on a particular band shifts, two QSOs could end up on the same frequency. Mature adults should be able to quickly comprehend what is happening, and resolve the dilemma by one of the parties offering to find another frequency (it's amazing how often I've heard 30-minute name-calling sessions as a result of shifting band conditions). When it's time for your net to start, and the frequency you've met on for 20 years is occupied, you should either move, ask the occupants of the frequency to move, or maybe even ask the occupants for a few seconds to inform your net members to stand by and wait.

There are numerous ways to accomplish this basic agreement among all radio amateurs, but we must start from a position of mutual respect and common courtesy. We are not dealing with brain surgery here. Nobody dies if you don't get to hold your net or scheduled contact on a particular frequency at a particular time. Yet, I've often heard suggestions of physically impossible acts and threats of physical violence exchanged between two adults, simply because 10 meters shifted and they found themselves on the same frequency. What is the matter with us?

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

April's conditions for the upper HF bands appears somewhat "iffy" with many Poor (P) and Fair (F) days in the forecast. It appears that the poorest conditions will be during the first and last days of the month, while the in-between days will range from Fair (F) to Good (G). The best days are likely to center around the 12th and the 22nd, and several days on either side of these dates. The full moon occurs on April 6th.

Use the daily chart to find the best days for your efforts and choose the Band-Time-Country chart to discover when and where to operate. Trends are indicated by hyphenated letters such as F-G meaning Fair-to-Good conditions expected, or P-VP meaning Poor-to-Very-Poor conditions are expected. Remember, however, that these forecasts are not cast in concrete, and that unexpected bonus days or terrible days may occur at almost any time. We're trying to "play percentages" here, so be on the lookout for sudden opportunities. Your best source for trends is WWW at 18 minutes after each hour (I use the 10 MHz signal as the most reliable copy from Arizona). They will tell you the status of the earth's magnetic field and the energy output of the sun during a 24-hour period. The sun's radio energy is measured at a wavelength of 10 cm, which seems to have a good correlation with actual propagation conditions on the HF bands.

April is historically a good month for communication and you can expect DX to the east in early morning hours, short skip during the day, and DX to the west in afternoon hours. The higher the band, the sooner it closes toward evening hours. 20 meters should stay open on Fair or Good days until after dark, while the 10, 12, 15 and 17 meter bands will close around sunset. You may try some DX on 30 meters in the mid-to-late afternoon, lasting until well after dark, although as I write this column, the 30 meter band seems to close soon after dark. 40, 80, and 160 meters are usually quite active into the "wee" hours of the morning, so if you are a "night owl" enjoy the opportunities that abound around 1-5 a.m. local time. During the active spring storm season there will be heavy QRN on many days... but these storms usually

subside after 10 p.m. local time as the solar energy that feeds the storms abates. Solar activity (flux) is dropping to the 100 level as I write, which means that ionization is not as great and does not last as long as a few months ago. Inasmuch as solar flux correlates with DX "conditions" and with the sunspot numbers, it is apparent that we are well on our way to the bottom of Cycle 22. During the DX heyday a few years ago, solar flux values of 200-300 were common.

Choose your days carefully from the chart, and correlate "conditions" with the Time-Band-Country/Area chart for the most likely success. As "conditions" deteriorate, you will need more power than usual to "get through," as well as better antennas.

EASTERN UNITED STATES TO:

GMT:	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
ALASKA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
ARGENTINA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
AUSTRALIA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
CANAL ZONE	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
ENGLAND	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
HAWAII	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
INDIA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
JAPAN	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
MEXICO	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
PHILIPPINES	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
PUERTO RICO	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
SOUTH AFRICA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
U.S.S.R.	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
WEST COAST	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135

CENTRAL UNITED STATES TO:

GMT:	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
ALASKA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
ARGENTINA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
AUSTRALIA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
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PHILIPPINES	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
PUERTO RICO	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
SOUTH AFRICA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
U.S.S.R.	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
WEST COAST	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135

WESTERN UNITED STATES TO:

GMT:	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
ALASKA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
ARGENTINA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
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INDIA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
JAPAN	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
MEXICO	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
PHILIPPINES	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
PUERTO RICO	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
SOUTH AFRICA	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
U.S.S.R.	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
WEST COAST	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135

*Try 80 meters.

The bands shown represent the highest usable at these times on "Good Days."

Note that the lower frequency bands first and close last.

APRIL 1993

SUN	MON	TUE	WED	THU	FRI
				1 P	2 P
4 F-P	5 P	6 P	7 P-F	8 F	9 F-G
11 G	12 G	13 G	14 G-F	15 F-P	16 P-F
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MAY 1993
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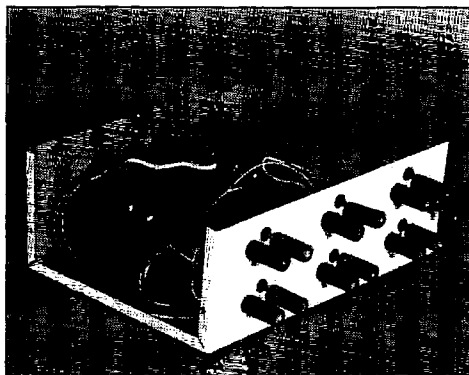
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73 Amateur Radio Today

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Cover: Coax is the lifeline of most amateur stations. Learn about this wonder wire on page 10. Photo by David Cassidy N1GPH.

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Contract: When's the last time you built something? The act of reading this question has just legally bound you to an agreement with Uncle Wayne whereby you promise to build at least one project within the next 30 days. In fact, why don't you get together with a few of your buddies and all build the same circuit or antenna? If you build from a kit, go ahead and write a review and send it in. OK... What are you waiting for?... Get to work!

NEVER SAY DIE

Wayne Green W2NSD/1



Do You Suppose? Maybe? Now, It's Impossible No Use Even Trying

There's something that's been puzzling me for ages. Actually, now that I come to think of it, there've been several things that have been puzzling me, and which now make sense. Like how come no one has written any really creative classical music in the last 50 to 60 years? Like how come so many readers tell me they don't always agree with my editorials? Like why we Americans put up with the crooks we've been sending to Washington; our crummy post office; our dreadful schools . . . the most expensive and worst in the industrial world . . . and so on.

I've seen the same pattern in amateur radio, with an infinite tolerance for League mendacity, and of course there's this whole CW nonsense.

Yes, I admit I'm probably part of the problem in that I tend to be much too cautious about speaking my mind. Allen Turoff, the chap who invented the game of Boggle and an old car rally buddy of mine, used to call me Wishy-Washy Wayne because I was so hesitant about expressing my opinions . . . and so insecure in them, once they were tried out of me.

Suddenly several things which have been puzzling me fit together and made sense when I read a book by John Gatto. He's the New York State Teacher of the Year you've probably seen on TV, and his book, *Dumbing Us Down — The Hidden Curriculum of Compulsory Schooling*, is a corker. For the few of you who have survived our school system and actually read, I'll make copies available through Uncle Wayne's Bookshelf.

I semi-survived our public school system, but it so numbed me that it wasn't until I went through a new kind of psychotherapy when I was 28 that I was able to actually start thinking. That's when I started reading and building my library. I referred to this therapy when I described how the mind works in my October 1992 editorial. I'll eventually explain how almost anyone can help others to start thinking and stop just reacting.

John Gatto's book is the most devastating indictment of public education I've seen yet. Oh, we've known for

over 10 years that we have one of the worst educational systems in the industrial world . . . which makes up for its terrible results by being one of the most expensive. But what we haven't considered, and what even John Gatto hasn't suggested, is that the end result of this lousy system has been a throttling of creativity and genius, a generally negative approach to new ideas, and a fear of opposing the system.

If you stop and think about it, not only haven't we seen any really outstanding composers in the last 60 years or so, we've also seen a drop in creativity in art, literature, poetry and so on. We've seen a deterioration of the whole country. Now I think I know what's gone wrong.

When I read a book I keep a Highlighter at hand. Well, my Gatto book is an epic in yellow swatches. Unfortunately, since you are a product of our educational system, the chances are that you find books boring, and besides, you know that there's nothing you can do to change things, so why bother. Even so I'm going to make this book available to the few of you who have escaped being totally destroyed by the system and who still have some shreds of interest in understanding what's happened to all of us. It's available from Uncle Wayne's Bookshelf. Once you read it you will want to get copies for what few friends you have who are functionally literate.

What Our Children Are Actually Being Taught

John points out that he teaches seven basic concepts. He teaches confusion by dealing with subjects out of context and not relating them. Curriculums have no coherence.

He teaches class position . . . to envy and fear better classes and have contempt for lower classes and groups. He understands that truth and schoolteaching are incompatible, as Socrates pointed out thousands of years ago.

He teaches indifference . . . that no job is worth finishing, and this is driven home by bells, which stop everything in midstream. Nothing is worth finishing, so why care?

He teaches emotional dependency. Rights do not exist inside a school . . . not even free speech . . . unless the

teacher says they do . . . not even to go to the toilet.

He teaches intellectual dependency. Successful students do the thinking he assigns them, with little resistance and a show of enthusiasm. Curiosity causes trouble, so conformity is rewarded. Wait to be told what to do.

He teaches provisional self-esteem. The lesson of report cards, tests and grades is that children should not trust themselves or their parents, but should rely on the evaluation of certified officials.

He teaches that one can't hide. In school there are no private places. Children must be closely watched if you want to keep them under tight control.

He says, "It is the great triumph of compulsory government monopoly mass-schooling that among even the best of my fellow teachers, and among even the best of my students' parents, only a small number can imagine a different way to do things . . . the truth is that reading, writing, and arithmetic only take about one hundred hours to transmit as long as the audience is eager and willing to learn."

Now is it entirely a coincidence that artistic creativity dwindled as public education took hold? It was started in the mid-1800s by a group of socialists, but didn't take over completely until around 1880, when the militia finally forced parents at gunpoint to send their children to public schools. The system grew in administrative bureaucracy and control through the 1920s.

Gatto says, "When children are given whole lives instead of age-graded ones in cellblocks, they learn to read, write and do arithmetic with ease." He points out, "Out of the 168 hours in each week my children sleep 56. That leaves 112 hours a week out of which to fashion a self. Children watch 55 hours of television a week. That leaves them 57 hours a week in which to grow up. They attend school 30 hours a week, use about eight hours getting ready for it and traveling to and from school, and spend an average of seven hours a week in homework, a total of 45 hours. During that time they are under constant surveillance. That leaves them 12 hours a week out of which to create a unique consciousness. If we allot three hours a week to

evening meals we arrive at a net amount of private time for each child of nine hours per week."

Gatto suggests that this develops dependent personalities and that this has a lot to do with the things that are killing us, such as narcotics, brainless competition, recreational sex, violence, gambling, alcohol, and the accumulation of things as a philosophy. This is what this brand of schooling must inevitably produce.

The results he sees are children who are indifferent to the adult world, who have almost no curiosity, who have a poor sense of the future, who have no sense of the past, are cruel to each other, are uneasy with intimacy and candor, who are materialistic, and who are dependent, passive, and timid when faced with new challenges. Is it any wonder that he says we don't need more schooling, we need less? He believes that education should make you a unique individual, not a conformist.

When I see teenagers with the knees out of their jeans I know I'm looking at conformity-driven kids who have been so brainwashed they're unable to think for themselves. When I get letters from readers who tell me they don't always agree with what I write I know I'm dealing with someone who has never learned to think. No, I don't mean everyone has to agree with everything I write. If that's your reaction, it proves you don't get it . . . and may never "get it." When someone disagrees with me I expect the honesty of them telling me what they don't agree with and what information they have to substantiate their opinion.

It is rare that I meet survivors of our school system who think positively. The normal reaction to ideas is to come up with reasons why they won't work. These are usually emotion-driven, not logic- or thought-driven.

I have to admit to being frustrated by the infinite capacity of the American people to accept the screwing the government is giving them. They may grouse a bit, but are terrified if there's a suggestion that they might be quoted. They are annoyed at the massively crooked Congress they've elected, yet they just re-elected 93% of the incumbents. They watch the exposés of graft on TV with passive frustration. They are annoyed by the \$500 billion savings and loan fraud, which Congress abetted, the billions stolen from one government agency after another, the billions wasted by the military, the lousy performance of the post office, our schools, our health care system, and our inability to deal with welfare, crime, drugs, and so on. But do anything about it? No way!

In amateur radio we have the mindless support of CW. You're just lucky that I am so circumspect about what I think and don't come right out with my opinion. Yes, I know all the rationalizations for CW. I've been hamming for over 50 years, so you have no news for me. Yes, I know CW is lun, I never said it wasn't. And yes, I know you feel

Continued on page 80

LETTERS

Number 2 on your Feedback card

From the Hamshack

Dan Sealy AA7OA, Astoria OR
Wayne, I have been reading your editorials and responses to our letters for some time, and now I think it's time to respond.

I usually agree with you on most issues. I would, however, like to give you my two cents worth.

First, I don't agree with your constant lambasting of the ARRL. Almost every 73 issue has something bad to say about that organization. Most QST's don't even mention 73. Now, I don't for a moment believe that the ARRL is fairly and equally representing the interests of amateur radio, nor do I blindly agree with much of their policy. I do think that theirs is a case of absolute power corrupted absolutely. I am a member of the ARRL not because I swallow everything the organization says and does without question, but because I at least want to have a vote in how the organization evolves. My vote may count very little in the ARRL scheme of things, but at least I have the right to complain.

For example, you frequently write of the failure of the "incentive licensing" program. I don't think that it has failed at all. I don't think that it is as much of a success as the ARRL would like everyone to believe, but the system does work. I have been a ham for just under two years. When I started, I earned my Technician with HF license. As my involvement with amateur radio grew, I came to realize that the real ticket to amateur radio was access to the HF bands (at least for now). The incentive to upgrade was real and compelling.

I have no problem with a class system for the licenses. If someone wants to be able to use a particular frequency, then work a little and get the appropriate license. It isn't that hard. You have said in many editorials that there is a great big world out there just waiting for some entrepreneur to come along and reap the harvest. I don't think that you meant that one doesn't need to work to achieve those rewards. The world today includes too many who believe that the world owes them a living, and that it isn't necessary to work for what you want.

You constantly write about the elimination of CW in favor of the modern digital modes. Why? What is wrong with CW? If it serves no other purpose than a "rite-of-passage," so be it. There isn't anything wrong with that. Almost everything we do has some form of the rite-of-passage: work, school, sports and others. Few people start out in the job market as supervisors or managers. We work for it. The old-timers usually watch the new kids do the dirty "grunt" work. We work hard to graduate from school.

Along the way we might learn old, outdated material that serves no immediate purpose. The new player on the football team usually warms the bench for the more experienced players.

I have come to appreciate CW as another mode, but I don't think it is the "end-all," "be-all" of amateur radio. Sure, it's old, but so are Model T's and antique airplanes, and I know several who would pay dearly for both. It isn't fast, but it is reliable. You don't need a \$500-to-\$5,000 computer, TNC, and radio to make it work. You can get on the air for very, very little money, and communicate all over the world.

Finally, your statement in the February issue that amateur radio "is a government sponsored entertainment medium" is probably true, but the part about our frequencies being worth "tens of billions of dollars" is false. Sure, some of our frequencies (mainly above 6 meters) are valuable to commercial interests but, with the exception of shortwave broadcast stations, no other commercial interest would put up with the uncertainties of propagation, fading, solar flares, and other conditions which make HF only fairly reliable. Besides, as you stated, the advent of cellular telephones has made our frequencies even less valuable to commercial interests as a communication medium.

By the way, 73 is the only amateur radio magazine I subscribe to, other than receiving QST as part of my "membership."

Dan, your memory is in trouble. There's little connection between the 1964 Incentive Licensing debacle, when the ARRL destroyed the entire American amateur radio manufacturing industry, and the current licensing system. Your memory is also in trouble on CW, which I've never proposed eliminating. I've always been a champion of using CW for fun. You sure have a way of thinking in terms of straw men and then demolishing them. I never suggested our HF frequencies are worth billions. Millions, yes. It's our completely unused microwave allocations that are priceless, as I've emphasized many times ... Wayne

David J. DiCenso WB1CDG I have been reading your magazine for years (since about 1978). I have been pleased at the consistency of the magazine and the enthusiasm about the hobby that is evident in the pages of 73.

The most useful and exciting column that you have offered is Mike Bryce's "QRP" column. That column is the first one that I turn to when I pick

up your magazine. Thanks to Mike Bryce's column, I have dusted off my soldering iron and have become an active builder again. His column's schematics and information are always useful and very helpful. Often when I discard old issues of 73, I make it a point to save the "QRP" column.

Randall M. VanVoorhis KD4DWF, Killeen TX Several months ago you printed a letter of mine mentioning a questionable hard-core push for interesting newcomers in the hobby. The letter got many responses, from "Why did you go and give our club a bad rep?" to "Pretty good," and "Not bad."

Since then I have joined the Air Force and moved from Memphis to Killeen, Texas (aka Ft. Hood Army Installation). Upon my arrival in Killeen I turned on my radio and put out a call and was immediately greeted by Frank N2HNU. After speaking for a while, we exchanged 73s and QRT'd. Later that evening, having received a Poor Man's Packet modem from a friend back in Memphis, I tried to get on the air. Because I had no prior packet experience I gave Frank a quick call to ask some questions. After he spent almost an hour trying to help me over the phone, he gave me the number of the local packet guru. Both calls were toll calls.

We finally got my station up and running. After several packet contacts I ended up on voice with three "local" hams. We chatted and I got to know about them and the area and they got to know a bit about me. These contacts resulted in my getting to know some of the locals, becoming familiar with the different repeaters, and receiving an invitation to join the Temple ARC.

This is another fine example of the hospitality that makes me like to associate with hams. I still have only my No-Code Tech license. I guess I'll get your 20+ wpm tape and upgrade. It's not that far to Extra.

I am a big W2NSD fan and support you 100%. I make a point of mentioning 73 every time I contact one of your advertisers and for your new advertisers, I usually circle their Reader Service number and, of course, in any further contacts 73 is mentioned.

Your point about the audit is a very valid one and I hope the advertisers do take note of your outcome and request an audit of the other publications they may advertise in.

Being in a big state like Texas and close to several "major" cities, I was wondering if you have any plans to attend a hamfest so that I can meet you face to face and shake your hand for all of the excellent work you are doing, not only in ham radio but also in the circus ring called politics.

Randall, I hope your last letter got those cretins to stop and think about their antisocial behavior. We don't need hams like that.

Texas? I don't remember anyone asking me to come down for a ham-

fest recently. Oh, I don't blame 'em. ... I'm probably pretty dull these days, more interested in talking about getting our country fixed than in amateur radio minutia ... even though a big part of my proposals entail generating a million or two new young hams ... Wayne

Chet Smith WB2LUQ, Verona NY 13478 I want to state that I, for one, think the space utilized in 73 for your editorials is put to good use. I've gotten many a good laugh out of some of the responses to your observations. There are, naturally, some of your views that I disagree with. For instance, the idea that everyone who is anyone should have more than adequate supplies of cash to pursue any and all aspects of amateur radio. Also, your less than enthusiastic view on the issue of AM operation. Actually, I see these two points as somewhat related. When I started out, I was still in high school and cash supplies were limited, to say the least. So I went ahead and got my Novice license, and got on the air with a used rig that did have facilities for AM operation. So, not surprisingly, when I upgraded some months later I was able to, and did, get on AM. There were some local guys here who were on so we did make a go of it. No, I'm not on at present, but I do have an old Heath Apache/Mohawk combination that I fully plan to get on with good audio, as far as I can tell. And most AM stays on or near certain agreed frequencies, much like RTTY ops and other alternate mode operators. I simply think that not everybody necessarily has a couple of thousand dollars floating around to use in pursuit of their hobby. I certainly wasn't in that category when I started out, and I'm sure I wasn't the only one.

There's a lot of truth in what you've mentioned from time to time about operating from the other end, getting on from other countries. I came back from over four years in the Marshalls a few months ago, so I have been experienced in that regard. There are all kinds of different clubs on the Island, but KX6BU (Kwajalein Amateur Radio Club, now V7BAX) is the oldest established club there, and had its origins soon after WWII ended.

Over the years I've had some interesting experiences operating at some other club stations' facilities. When I was in the Navy (from 1981 to 1987) I was fortunate to be able to operate from K9NBH, and later from WA4ECY. The club at K9NBH was pretty much defunct, but ECY was a pretty active group. To get back to one of your points, though, I am sure that reviving club stations at high schools and colleges would help immensely, not only in getting more hams, but also in helping us with our sad deficiency in American engineers and techs. I know that I'm not alone in saying that I would have enjoyed school a whole lot more if we could have had some sort of facility at the school.

Unlicensed Ham Operator Heading Back to Prison

The only amateur radio operator ever to be imprisoned for illegally transmitting on ham radio is headed back to the pokey. Richard A. Burton, 48, of Harbor City, California, was sentenced to prison on Monday, February 22, for talking on his 2 meter radio without a license. He used to be WB6JAC.

Burton has a long history of repeated amateur radio violations going back more than a decade. The FCC initially revoked Burton's ham ticket in 1981, but that didn't keep him off the amateur air waves. A 1984 federal court found him guilty of transmitting on the ham bands without a license . . . and using obscene language.

The obscenity charge was later overturned but the license revocation continued. He was sentenced to a four-year federal prison sentence which was later reduced to six months, to be followed by a five-year probationary period. He served the sentence at the Lompoc (California) federal detention facility; the probation was over in 1989. In 1990, Burton was once again monitored on the 2 meter band and convicted of operating without a license. This time he was ordered to undergo therapy.

Last summer, Burton was again cited for making several illegal unidentified 2 meter ham radio transmissions after the Los Angeles FCC Office tracked his broadcasts to a Redondo Beach address. He pleaded innocent and was ordered to return to federal district court for jury trial last November.

On December 1, 1993, Richard Burton was convicted on all four counts of operating an amateur radio station without a license. This was his third conviction. He could have received up to a two-year prison sentence and a \$10,000 fine.

After the prison sentence, Burton must undergo psychological counseling and perform 500 hours of community service. *Los Angeles Times* writer Bob Pool quoted Burton as saying, "I think I need to get myself another hobby." *TNX W5YI Report*, Vol. 15 Issue #6, March 15 1993.

Fake Distress Calls

As part of a plea bargain arrangement, Jorge Mestre NS3K of Fairfax, Virginia, has surrendered his amateur Extra class license and must dispose of his ham radio equipment within 60 days. Mestre pled guilty to willfully making fabricated 20 meter distress calls last summer on 14.313 MHz. The SOS supposedly involved a sinking ship located in the West Indies. Ham operators notified the Coast Guard and the FCC. The massive search and rescue effort cost the Coast Guard more than \$100,000. Mestre has agreed to make \$50,000 in restitution.

The prank distress calls were traced to Mestre through the efforts of the FCC's long-range direction finding network, computer anal-

ysis of tape recordings, and "signature print" comparison tests on Mestre's equipment, which was later seized on a federal search warrant. He will be sentenced on May 7th and faces six years in prison and a \$250,000 fine. *TNX W5YI Report*, Vol. 15 Issue #6, March 15 1993.

TV Series Coordinated on the Ham Bands—Producers Leased Radios From Commercial Firm

During mid-February, a Fort Worth, Texas, amateur scanning the amateur 420 MHz ham band came across transmissions that didn't sound like ham radio. They sounded like unidentified business communications. He called the FCC and retransmitted the signals over a local repeater so the FCC in Dallas could hear them. An engineer was later dispatched to Fort Worth to investigate. The operation was located through close-in direction finding techniques.

It turned out that Cannon Television, Inc., of Irving, Texas, and a West-Coast-based television crew had rented 36 Motorola P-200 handheld radios to direct operations for "Walker, Texas Ranger"—a television series being produced in downtown Fort Worth, starring actor Chuck Norris. The problem was that the radios were apparently unlicensed and were programmed to operate on 443.0125 MHz and five other nearby frequencies in the 70 cm ham band.

The Dallas FCC Field Office issued a *Notice of Apparent Liability for Forfeiture* (an FCC administrative fine) in the amount of \$8,000 against Cannon Television, Inc., for operating unlicensed radio stations.

The radios were apparently labeled with the proper business band channels but were programmed to operate on the ham bands in between simplex 70 cm frequencies. The television series' producer, Bob Hargrove, said he knew nothing about the legalities of "radio"—only that he routinely rents them all over the United States for shooting on location. "We had someone fly in from Houston that night to reprogram the radios," he said. "Delt Communications (the Houston company that rented out the radios) is also confused as to what went wrong. These same radios were used on two Oliver Stone movies here—and numerous other pictures. No one has had a problem." *TNX W5YI Report*, Vol. 15 Issue #6, March 15 1993.

FCC Issues \$10,500 Fine for Malicious Interference

The FCC has handed a ham a record \$10,500 Notice of Apparent Liability to Monetary Forfeiture. The fine was issued to Richard L. Whiten WB2OTK of Taylors, South Carolina, for what the FCC called "malicious interference to the communications of other ham radio operators." The operators the FCC says Whiten in-

terfered with are Michael Galego KA4MUJ of Ft. Lauderdale, Florida, and Judith Duehring KA1SKV of Maynard, Massachusetts. Galego and Duehring are publicly avowed followers of the anti-service net "Better Amateur Radio Federation," headed up by convicted felon Herbert L. Schoenbohm KV4FZ.

The FCC's Kingsville, Texas, office says it monitored and recorded a conversation on the frequency of 14.314.7 MHz on September 26, 1992. According to the January 19th NAL, Whiten did not dispute making the cited transmissions but did deny that they "constituted willful and malicious interference." Whiten told the FCC that, "if [he] had truly wanted to willfully and maliciously interfere [he] could have done so to such an extent that communications between other amateur radio operators would have been impossible."

But the FCC Engineer-in-Charge Oliver K. Long, who issued the fine, looked at this as a simple case of Whiten interfering with other amateur communications, that Whiten has in writing admitted his guilt, and that he therefore is subject to the administrative penalty as prescribed. The notice says that the base amount of the fine is \$7,000 but that it has been adjusted upward another \$3,500 dollars because of what EIC Long says is Whiten's "repeated violation of rule 97.101(D)."

The FCC gave Whiten 30 days (from January 19) to either pay the fine or file a petition for reduction or non-imposition of the penalty. In a telephone interview on January 24th, WB2OTK told the Amateur Radio Newsline that he has no intention of paying the forfeiture and plans to hire a Washington, DC, attorney who specializes in communications law to fight the matter through the administrative appeals process, and if needed, into the federal court system. *TNX Westlink Report*, Number 643, February 18, 1993.

More Fines for Malicious Interference

The FCC has issued another Notice of Apparent Liability, this time for \$2,000 against William A. Moskowitz KA3HSZ of Plano, Texas.

The FCC's Vero Beach, Florida, office issued the notice on January 14 after having monitored Moskowitz on November 26th of last year. The NAL says that during a 17-minute period, the government observed him changing operating frequency twice in the vicinity of 14.313 MHz, "in order to interfere with ongoing communications."

"The violation was willful," the FCC said.

The public notice also said that the Commission is "treating this as a minor violation." Since Moskowitz is an individual, because of the nature of the violation, and because it is a first offense, the Commission set the fine at \$2,000. The FCC's base forfeiture for malicious interference is \$7,000.

Moskowitz has the usual 30 days to pay the fine or appeal it. *TNX Westlink Report*, Number 643, February 18, 1993; ARRL.

The Hows and Whys of Coaxial Cable

How to select the most appropriate kind for your need.

by Steve Katz WB2WIK/6

Hams have used coaxial cable for transmission lines almost since its invention nearly 50 years ago, but many don't know why or how this trend started. Although much has been written on the subject, I'm frequently startled to hear so much misinformation chatted about on the ham bands, even by old-timers who should know better. Perhaps this article will help newcomers and old-timers alike clear up misconceptions and make more educated decisions regarding this important piece of station apparatus.

Why Coax?

Why do we use coax, and why is most of it 50 ohms nominal impedance?

This is the best question anyone can ask. Before there was coaxial cable, amateurs and professionals alike used primarily open-wire transmission lines, typically in the 300 to 600 ohm nominal impedance range. Sometimes they used no transmission line at all—they just directly fed antennas with a single piece of wire. In the latter arrangement, the connection wire became part of the antenna system itself, and radiated along with the antenna. The drawback to this scheme was that the connecting wire's orientation would play a critical role in antenna performance, and often a high-voltage point would appear right at the antenna connection to the transmitter, creating both RF interference and even possibly fire hazards when the wire would come in proximity to combustible materials.

Open-wire "balanced feeders" helped solve some of these problems. Because the currents in the feeder wires were balanced (assuming a well-balanced load, or antenna), feedline radiation was minimized and the RF field contained to a very small area around the wires. By orienting the feeders perpendicular to the intended antenna field, antenna radiation pattern distortion would also be minimized and antennas could be better optimized. Open-wire "balanced feeders" were also a natural for connecting vacuum-tube push-pull amplifier circuits to balanced antennas without the need for complex matching networks. Tube amplifiers are normally high-impedance devices whose output

impedance is roughly equivalent to the plate voltage divided by the plate current of the output stage. Thus, a tube amplifier with 1,000 volts on the anode, drawing 500 mA anode current (this is a 500 watt stage), would have a plate load impedance of about 2,000 ohms. Matching 2,000 ohms to a 600 ohm open-wire feeder connected to a 600 ohm balanced antenna required only a transformation ratio of 2000:600, or 3.33:1, which was easily achieved by a very simple, low-loss "link output" circuit.

The problem with open-wire lines, and

"Coaxial cable solves a great number of problems and that is why it is used so universally in amateur as well as non-amateur communications systems."

"twin-lead," which is identical to open-wire except that the dielectric (spacer insulation) is a continuous strip of material (such as polyethylene), is that they are adversely affected by conducting objects in close proximity to them. They cannot be taped or otherwise directly attached to metal towers, masts or antenna booms, and even water, snow or ice laying on them dramatically increases their losses. Twin-lead and open-wire feedlines must be carefully insulated and spaced from all surrounding objects and cannot be directly buried beneath the earth. Besides all this, they still radiate to some degree, especially if terminated in any kind of unbalanced load. And, although the current in high-impedance feedline is lower than it would be in lower-impedance (coaxial) cable, making IR (ohmic) losses lower, voltages are much higher, to the point where exposure to living organisms (like people!) can be deadly hazardous. For example, if someone were running the amateur legal-limit power level of 1,500 watts PEP output and using a 600 ohm antenna and feedline, the voltage across the feedline would be 948.68 volts (calculated by the for-

mula: $E = \sqrt{P \times R}$

This is quite a lot of voltage and is considered by all authorities to be extremely hazardous.

Coaxial cable to the rescue! Coaxial cable is self-shielding and, if well-made, does not radiate at all when properly terminated in a matched load. Since the outer conductor (shield) normally operates at ground potential, coax can be secured to all sorts of objects, including tower legs, metal masts and booms, and almost anything else that comes to mind, making its installation extremely uncritical. If the coax has the proper outer jacket material, it may be buried beneath the earth for many years without degradation. Coax is unaffected by the presence of water, snow or ice. Although the nominal impedance of coax is lower than open wire line and it therefore has higher IR (ohmic) loss, its lower impedance allows direct power transfer to low-impedance antennas (a half-wave dipole in free space, for example, looks like 70 ohms) and keeps the voltage across the feedline and antenna connection points to a safer level. A 1,500 watt PEP output transmitter connected to a 50 ohm antenna will have only 273.86 volts across the feedline—still a somewhat hazardous level, but about one-fourth that obtained using a 600 ohm system. Because coaxial cable's working voltage is quite low, its insulating dielectric material may be optimized for minimal loss, rather than maximum insulation resistance.

Why 50 Ohms?

Clearly, coaxial cable solves a great number of problems and that is why it is used so universally in amateur as well as non-amateur communications systems.

"Why is most coaxial cable 50 ohms nominal impedance?"

This can best be answered in two parts: (a) Coax isn't all 50 ohms, but commonly runs from 30 ohms to 90 ohms, and sometimes even a bit higher when called for. Impedance selection is very application-dependent. (b) 50 ohms represents an excellent compromise between the lowest possible transmission

loss, which occurs at 70 ohms nominal, and the highest possible power handling capability, which occurs at 30 ohms nominal. Because of these factors, 50 ohms was settled on as the best all-around impedance for the widest variety of applications. To this day, 70 ohm cable is used almost exclusively in receive-only applications where no power transmission is required (such as cable TV systems).

Cable Specs

If 50 ohm coax is the best thing to use, I guess I should buy a big roll of RG58/U and use it everywhere. Isn't that right?

Yes and no. RG58/U might be great stuff, but again, most choices in life are application-driven and one needs to consider the specific use before making an intelligent cable selection.

First of all, what do the "RG" numbers mean? Well, these indicate that the cable is *registered* (simply a matter of someone spending the money and filling out a few forms). Cables which are truly RG-XX-/U are also "mil-qualified," which means they are certified for lot compliance with MIL-C-17D, the general military specification for wire and cable, and manufactured in a qualified facility. The two- or three-digit number after the "RG" prefix means absolutely nothing by itself: You need to refer to MIL-C-17D to see exactly what the cable designator means. The numbers are arbitrarily assigned in numerical order, from 1 to infinity, and only tend to indicate the age of the product's registration. For example, RG8/U is a much older product than RG213/U, which is essentially identical except that RG213/U is a *QPL* (MIL-C-17D qualified) product, while the older RG8/U no longer is, having been replaced by the newer part number. Many amateur coaxial products are not mil-qualified at all, but might still be imprinted and sold as "RG" products. Usually, if these are identical to mil-spec cables but are simply not qualified, they will be labeled with the word "TYPE" after the part number: For example, Belden 9913 is "RG8 TYPE" cable but is not RG8/U. Other non-qualified products might simply leave off the "U" suffix, such as "RG8X" or "RG8M" mini-8 cable. Admittedly, it's all a bit confusing.

How to Choose

Since most of us will be using 50 ohm cables in our stations, the most important parameters to consider in making product choices include: (a) transmission loss; (b) power handling capability; (c) flexibility; (d) availability of standard and reasonably-priced connectors; and (e) resistance to weathering and ultraviolet (UV) exposure. These parameters vary in importance and not necessarily in the order I've listed. Again, the selection is and should be application-dependent. Oh, yes—I've almost forgotten the most important parameter for many hams: **COST!**

In general (but not always), the larger diameter the cable is, the lower its loss will be

at any given frequency. This is because the leading contributor to transmission loss is the ohmic resistance of the conductors, which are usually copper, and the larger the cross-section the conductors have, the lower their resistance will be. But if loss were based on conductor size and ohmic (DC) resistance alone, coaxial cable would have the same loss for a given length at all operating frequencies, from DC to microwaves. That is *not* the case.

There are two other factors that enter into the RF loss equation (and they do not apply to DC circuits). One is a property called "skin effect," which assumes that AC (and RF) currents will flow only in the outermost surface of any conductor and therefore conductors could be hollow (with no center core at all) and be just as effective as solid conductors for any given diameter. The other is dielectric (the spacing insulation between the center and outer conductor) loss, which increases directly with operating frequency for most commonly used dielectric materials. The "skin depth" of a conductor becomes more and more shallow as the RF fre-

"It pays to select coaxial cable which has commonly-available, reasonably-priced connectors that will fit."

quency is increased, meaning that a more and more shallow region of the conductor is used as we work our way up the spectrum. This means that a given conductor will have loss that increases with frequency, as less and less of the conductor is actually used.

There is a third factor that applies mostly to *flexible* coaxial cables (the most-used kinds in ham stations), and that is radiation loss, which also increases directly with frequency as the outer conductor, which is made of braided materials to add flexibility, becomes a less effective shield for containment of RF energy. Solid outer-conductor cables (semi-rigid, rigid, "hardline," etc.) typically don't suffer radiation losses.

The bigger the cable is in diameter, the more power it can usually handle, since the conductors will have less loss and thus dissipate less power (generating less heat) and the insulating materials tend to be thicker, too, sustaining higher operating voltages. An exception to this general rule are the Teflon dielectric cables, which have great power handling ability even when small in overall diameter. This is because Teflon can withstand much greater heating than normally-used insulating materials, like polyethylene, and it has a higher dielectric withstanding voltage for a given thickness. This is *not* to say that Teflon cables are superior to standard polyethylene ones—they are not, except as regarding power handling for a given diameter. In general, Teflon cables are actually *inferior* to standard polyethylene-insulated coax in almost all other respects be-

cause Teflon has a high dielectric constant, creating the need for smaller center conductor size (for a given nominal impedance) and increasing dielectric losses. An example of Teflon coax is RG400/U, which is about the same size as RG58/U but will withstand more than 10 times the power; however, RG400/U actually has *more* transmission loss than standard RG58/U and costs about 10 times as much!

Throughout the HF spectrum, hams use "UHF" or "PL259" type connectors almost exclusively because commercially-made gear is already fitted with their mating receptacles (SO239) and they are good, high-power, inexpensive fittings that are very useful through 144 MHz or so. However, on 220 MHz and above, the connector of choice is the Type "N," which has a variety of military designators, mostly UG21D/U. The Type "N" connector surely costs more than the "UHF" PL259 type, but is actually easier to install and is a far superior connector throughout the VHF/UHF/SHF spectrum. In fact, some Type "N" fittings work well through 12 GHz (12,000 MHz)! For smaller cables, both PL259's with appropriate "reducers" (type UG175/U and UG176/U for RG58/U and RG8X types), Type "N" and "BNCs" are commonly used. BNCs are very good fittings through the UHF and SHF spectrum and, when properly installed, have no measurable loss at 1 GHz. However, because of their mechanical frailty they are best used with small-diameter cables like RG58/U, RG174/U and so forth.

In any case, it pays to select coaxial cable which has commonly-available, reasonably-priced connectors that will fit, or you may find yourself with \$5 worth of cable that will require \$200 worth of connectors to attach to anything. The "standard" ham coaxial lines (RG58, RG8, RG213, even RG217 and RG17 for those with the budget and need for giant-sized cables) all have readily-available and reasonably-priced fittings. Probably the only caveats in the market are "surplus" cables which cannot be readily identified and "hardline" cables, which do require special connectors that can sometimes cost a small fortune.

Beware of double-shielded coaxial cables! These are often found on the surplus market and, while they might be wonderful in many respects, they can be difficult to use, to flex, and to find connectors which fit. For example, the double-shielded version of RG213/U is RG214/U. These two cables have exactly the same electrical properties, the same transmission loss, and so forth, but the double-shielded type will *not* fit a conventional connector which is intended for single-shielded cable. Why would anyone want double-shielded cable? For very specific and demanding applications, where a few dB of additional shielding is very important. Connections within full-duplex repeater systems come to mind as a good application. If you don't own a repeater, there's no reason I can think of to use double-shielded cable. It's generally more trouble than it's worth.

Specific Questions

After contemplating all of this confusing information, what in the world should I use to feed my 40 meter dipole?

Great question! That's getting down to specifics. Unless you intend to run the legal power limit (1500 watts PEP output), I'd usually recommend RG58C/U (for runs up to 50' long and power levels below 400 watts PEP) or RG8X (for runs up to 150' long and power levels below 1000 watts PEP). These are both very flexible, lightweight cables which will exhibit very low loss on 40 meters in the lengths I've specified, and their only restriction will be power handling. For legal-limit power, I'd recommend RG213/U, which is heavier and less flexible, but will withstand 1,500 watts all day long.

What about feeding my 2 meter beam?

Another great, specific question. The only question I'd ask in reply is, "How long will your feedline need to be?"

For lengths less than 50 feet, RG8X is a good, general-purpose cable for 2 meter use. A 50-foot run will have about 2 dB loss, which is not too much for most applications (like working FM repeaters and such), but might be excessive for demanding applications like SSB/CW weak-signal work where every dB counts. For lengths up to about 100 feet, RG213/U is a great choice. It will lose about 2.4 dB or so in a 100' run. For lengths beyond 100 feet, or for more demanding applications, I'd recommend Belden 9913, which is the same o.d. (outside diameter) as RG213/U but has somewhat lower loss, about 1.3 dB per 100 feet at 144 MHz. The drawback to the 9913 is that it is far less flexible than RG213/U and does not fit a standard Type "N" connector; however, special connectors for 9913 are available and don't cost much more than the standard ones. For very long runs, or highly demanding applications like EME (moonbounce), where every tenth of a dB starts to count) or full-duplex repeater installations, 1/2" or larger "hardline" or Helix is most commonly used.

I'd like to use a single feedline to connect my 146, 222 and 440 MHz FM antennas at home, using a "duplexer" at each end of the line to separate the signals. Any problems with that? What should I use?

There's no problem doing this, as long as you use high-quality "duplexers" (I'd prefer to call them signal-splitters, which is what they really are) on both ends, and remember to make the topside one, which will be exposed to weather, very waterproof. There are some multiband signal-splitters on the market which have almost immeasurably low loss (less than 0.5 dB) and will handle 150 watts or so. Since you intend to use the coax on 440 MHz, where losses will be the highest, I'd recommend RG213/U for short runs up to 50 feet or so, then Belden 9913 up to 100 feet, then commercial "hardline" or Helix for runs longer than 100 feet. Bear in mind that the "hardline" types cannot take repeated flexing, are quite inflexible to be-

gin with, and require specialized, costly connectors. But properly used, it's great stuff.

I have a 10-15-20 meter triband beam on a 70-foot tower located 150 feet behind my house. What do you recommend for coax to feed this system?

I'd probably recommend RG217/U or RG17/U in this case, and I'd bury it underground to get to the base of the tower. It will have minimal loss and is very high quality cable. Connectors are readily available (although they have a larger back end than connectors for RG8-sized cables and are not interchangeable), at least for Type N, and adapters can be used to mate with UHF fittings if necessary. Of course, you could save a lot of money by using standard RG213/U, but since you'll need nearly 250 feet of it, this stuff will begin to get lossy at 28 MHz. It's a matter of balancing your appetite for performance against your budget and trying to make the most educated decision possible.

"Properly-installed coaxial connectors have losses too low to measure if they are used in the spectrum for which they were intended."

I've heard that coax connectors all have loss, and every time you use one, you're giving up a dB or so. Is this true?

Not at all! Where in the world did you hear this gibberish? While everything has some loss in this imperfect world, properly-installed coaxial connectors have losses too low to measure, even with the world's most sophisticated laboratory equipment, if they are used in the spectrum for which they were intended.

A "UHF" connector, say type PL259ST, which implies a silver-plated connector with a Teflon dielectric (the best kind to use because they solder so easily and resist soldering heat so well), used at 28 MHz will have less than 0.01 dB insertion loss when mated to an equivalent receptacle. Similarly, a UG21D/U Type "N" connector, properly installed and mated to its equivalent receptacle, will exhibit less than 0.05 dB loss at 500 MHz! This is a whale of a lot less than 1 dB loss. The problem is, many amateurs don't know how to install connectors properly, and probably do end up with more loss than there should be. But 1 dB is an awful lot to lose, especially at the lower frequencies, where simply twisting the coax conductors together in a "mid-air" splice and using no connectors at all will usually result in far less than 1 dB loss.

Probably the worst misapplication of RF connectors is when hams try to use "UHF" PL259 types at 440 MHz. Most of them don't work very well at this frequency, and losses may be as high as 0.5 dB per connector or so if you're not careful. At 440 MHz and above stick with the time-proven, con-

stant-impedance Type N fittings.

My 220 MHz "mag mount" whip antenna came with RG174/U coax installed, about 10 feet of it. Is this lossy? Should I replace it?

At 222 MHz, 10 feet of RG174/U will lose about 1.3 dB or so. Replacing it with an identical length of RG8X will only lose 0.5 dB, so you'd pick up about 0.8 dB by making the change.

What about the coax sold by Radio Shack and similar retail outlets? Is it any good?

It can be, but it might not be. I don't mean to disparage Radio Shack or anyone else, but the problem with commercial, non-military cables is the lack of consistent quality. Since their cables are manufactured in non-qualified facilities and each lot does not undergo the rigors of considerable Quality Conformance Inspections, many times these products are less than desirable, especially for long-term installations. I'd not hesitate to use their stuff for patch cables around the shack, or for mobile installations and other non-critical applications where the cable can easily be replaced. But for more demanding applications or installations where replacement might be very difficult, I'd stick with the real mil-spec products, or at least try to find the highest quality commercial products available. Shop around a bit, looking not only at the price, but also at the product itself. Is the braid coverage very good (at least 95% of the dielectric should be covered by the braid, with no visible "holes" between the strands)? Is the outer jacket "UV stabilized" (that is, will it withstand continued ultraviolet radiation from the sun without contaminating the cable)? Is the run you intend to use free of splices under the jacket (usually visible as a small bump in the cable diameter)? If everything looks great, use it! If not, look elsewhere.

What about "foam" cables versus "non-foam"? What's the difference?

"Foam" cables use this term to refer to the dielectric material; it is cellular polyethylene, which looks a bit like foam rubber, and is softer and spongier than solid-dielectrics. The "foam" stuff is usually very white in color (although it needn't be) and you can permanently indent it with your fingernail. Foam cables tend to be a bit more flexible than those with solid dielectrics, and their transmission losses will be slightly lower for a given cable type and diameter. However, there are drawbacks. The cellular foam melts easily at a relatively low temperature, and once melted, it is permanently damaged. Because of this, foam cables are really intended for "crimp-on" connectors, not the solder-on kind, which obviously will expose the dielectric to very high temperatures during the soldering operation. Also, the nature of the foam dielectric is to absorb water easily, making the cable quicker to contaminate if the jacket is pierced or if a terminating connector leaks a bit of water. Solid dielectric cables are more robust and will withstand soldering heat better, and are also less prone to the absorption of moisture. Because

of the operating temperature restrictions, no "foam" cable is mil-qualified. However, throughout this article I have recommended RG8X for some applications, and RG8X is a "foam" cable type. Use it carefully.

Why does "foam" cable have less loss?

Two reasons. One, the cellular polyethylene has a lower dielectric constant than solid, so dielectric losses are somewhat lower. Two, because of this same fact, the center conductor will be larger in diameter (for the same outside conductor diameter) to maintain 50 ohms impedance. (The nominal impedance is a function of the inner conductor diameter as related to the outer conductor diameter, and the constant of the dielectric used between them.) With a slightly larger diameter center conductor, ohmic losses (and skin-effect losses at RF) will be somewhat reduced, without impacting the overall diameter of the cable. Whether or not you'll really notice the difference in loss will depend on the length of cable you use.

What about "9913"? Is it as good as they say it is?

"9913" is excellent with respect to transmission loss and power handling ability. It is often called "poor man's hardline" because it might be nearly as good as hardline, while costing far less. "9913" is really just an extension of "foam" dielectric cable. Instead of using cellular polyethylene, Belden (the inventor of 9913) uses a thin spiral of polyethylene dielectric material as a spacer to hold the center conductor in place, and a lot of the dielectric is really the air between the spiral turns. Picture the dielectric in 9913 as a long spring, with lots of coils and air in the spaces between. As a result, the dielectric constant is even lower than in "foam" cables, the center conductor is even larger and has less resistance, and everybody is happy as a clam. Of course, braided outer conductors for 9913 would never work, as there'd be nothing rigid enough to hold the cable together. So the manufacturers use a very thin wall of polyethylene, covered with aluminum foil to make the outer coaxial conductor. Since you can't really solder to aluminum foil, they cover that with some tinned copper braid material. The braid serves no particular purpose other than giving you something to solder to (for a PL259) or clamp to (for a type N).

The problem (and there's always a problem with anything that seems too perfect) is that 9913 is far less flexible than conventional cables, will not withstand repeated bending (due mostly to that big, fat, solid center conductor and the fragile aluminum shield), is easily contaminated by the very first droplet of water that might enter in past a connector, and is too fragile to rigidly clamp to a tower leg or other solid support. If you use proper precautions, 9913 is great stuff. If you don't you'll wind up replacing it frequently. Belden will be glad to provide you with an applications note on how to use 9913 correctly. It was really intended for crimp-type connectors, not solder-on ones, so be extra careful.

I've heard that a solid center conductor in coax is better than a stranded one. Is that true? If so, why?

No, this really isn't true. Since the RF currents flow only on the perimeter of any conductor, only the outside diameter of the center conductor is of consequence in determining attenuation. (The same is true for the inside diameter of the outer conductor, because that's where the current flows there.) To maintain a constant and desired impedance, the ratio of the o.d. of the inner conductor to the i.d. of the outer conductor must be a fixed, predetermined quantity for any given dielectric material. It doesn't really matter if the inner conductor is solid or stranded, as long as its o.d. (outside diameter) is correct to maintain the desired nominal impedance. Solid conductors are generally used in cables that will not be exposed to repeated flexing, like 9913 and hardline, while stranded center conductors are used in cables intended for flexing and smaller-radius bends because the stranded conductors are far more flexible. For this reason, I'd always recommend cables with a stranded

"In amateur installations, the factors that detract from the operating life of coaxial cable are typically abrasion, moisture, and UV radiation."

center conductor for routing in tight spaces, around rotators, in mobile installations, as "patch" cables for use around the shack and in other applications where flexibility is required. For example, rather than using RG58/U or RG58A/U, I'd recommend RG58C/U in almost all applications for small-diameter cable. The RG58C/U has a stranded center conductor while RG58/U and RG58A/U do not. A perfect example of the resilience of the stranded conductor cable is when it is used to attach a mobile "mag mount" antenna, where the car door may be repeatedly slammed against the cable. RG58/U might withstand this abuse only a few times before it finally breaks, while RG58C/U will withstand similar abuse hundreds of times because it is so much more flexible. (It's still not a great idea to slam a car door against the coax, but I know it's done, and will be done for years to come.)

I've heard that coax's ability to withstand UV radiation has something to do with the cable's suffix designator, like A/U, B/U, C/U, etc. What's the story on this?

Cables will last nearly forever if they're never exposed to excessive temperatures (hot or cold), weather, or ultraviolet radiation. Unfortunately, that means we really can't use them. In the real world, cables are exposed to all these things which impact operating life. In amateur installations, the factors that detract from the operating life of coaxial cable are typically abrasion, moisture, and UV radiation. UV radiation, which

gives us such great tans in the summer, can cause the plasticizers in the jacket materials of coax to "migrate" and flow through the braid and into the dielectric material. When this happens, the dielectric becomes contaminated and the cable's attenuation increases. To avoid this occurrence, manufacturers—especially mil-qualified ones—began using "UV stabilized" jacket materials (usually polyvinylchloride, or "PVC") which will withstand UV radiation under normal conditions without migration. Unless you intend to use all your coax indoors, where it will never be exposed to the sun's rays, it certainly pays to use coax cable that has a "UV stabilized" jacket material. This material is commonly called "Type IIA," an industry buzz-word for the enhanced properties discussed here. Old-fashioned RG8/U was not Type IIA; RG8A/U supposedly was, and replaced RG8/U on the military QPL (Qualified Products List) for MIL-C-17D years ago. Because of the confusion created by two such similar part numbers, RG8/U and A/U were dropped from the QPL entirely and have been replaced with RG213/U, which should automatically have a UV stabilized jacket, if it is real mil-spec coax. A similar story exists for RG58/U: The old number was not Type IIA, but RG58A/U, B/U and C/U. This is a bit confusing, so it pays when purchasing cable to find out for sure if the product has a Type IIA jacket material. All the newer mil-spec products do, but many commercial products don't. RG8X, which is a purely commercial product (and is not mil-spec in any form) is made by a variety of manufacturers using different materials; some are UV stable and some are not. RG8X and other commercial cables are often available with a white-colored jacket material, which may be desirable for those wishing to "hide" the coax against the side of a light-colored building or interior walls. Whether the white jacket material is UV stable or not, it will reflect the sun's rays better than a black jacket and run cooler and absorb less UV radiation than black-jacketed coax. The white-colored stuff is often used in marine applications, where UV exposure is the norm.

I used RG58/U to feed my 2 meter antenna for years, and its VSWR was always 1.2:1. I just replaced the feedline with brand-new RG213/U of the same length and now the antenna VSWR measures almost 2:1. Why is the new coax so bad?

Congratulations! You've actually improved your whole system by a large factor, and your new VSWR measurement is far more accurate. You're obviously measuring the SWR down at the rig, and not up at the antenna feed point, which is where it *should* be measured. Since VSWR is a ratio of feedline to load impedance (not rig to antenna!), a "flat" (1:1) SWR will only exist when the antenna impedance is exactly the same as the feedline's. If there's any mismatch at all, some reflected power will result. When you used RG58/U, a large amount of that reflected power was absorbed by the coax because

it had lots of loss. The reflected power just created some cable heating and never made it down to your VSWR bridge at the "rig" end of the line. Now that you're using less lossy cable, more of the reflected power is actually being conducted back to your bridge, and your rig, and less is being absorbed by the coax. This is a very normal condition. The new coax isn't "bad," it is probably far better than the old coax was. If you take the trouble to measure VSWR right at the antenna itself, you should find it will be the same with any 50 ohm feedline you connect to it. The best thing to do is re-tune the antenna, using a bridge connected directly to it (up on the roof, tower, or whatever) and try to optimize this match to 1:1 at the frequency of interest. If you can do this, there will be no standing waves on the feedline and the SWR will measure the same at the antenna, the rig, or anywhere in between. By the way, *all* the reflected power will eventually be absorbed by the feedline regardless of how much there is. This is an interesting subject on which much has been written, and there's insufficient space to cover it completely here.

How can I keep water out of my feedline?

A few simple precautions will prevent moisture from entering coax in most situations. The first is, when measuring, cutting and handling the cable, be careful not to create abrasion of the jacket. While some cables are nearly impervious to rough handling (like the ITT Impervion cables) because they are "self-healing," most are really quite fragile. Don't drag your coax across the pavement or roofing materials, and don't yank it through the legs of your tower. Treat it as though it were expensive silk fabric that could be easily damaged—because it can.

The second thing is, install the exposed connector (the one that attaches to your antenna) in a precise, proper and professional manner. Make sure the jacket ends *inside* the RF connector, and that no braid is exposed after the connector is installed. Then, weatherproof the connector as well as possible. "Coax Seal" weatherproof putty works well, if its directions are followed carefully. This stuff molds itself around the connector and the coax near the connector and is very weather resistant. Lacking "Coax Seal" or something similar, you can try spraying the connector and a few inches down the coax with Krylon "Klar Kote", then wrapping with overlapping layers of high-quality vinyl tape like 3M "Scotch 88" electrical tape, then spraying over the tape with another coating of "Klear Kote." It is not impossible to make an exposed RF connector totally weather resistant, it just takes some practice and some patience. Then, *don't* pull the coax straight away from the antenna connector and run it down a mast, boom or tower leg: Make a "drainage loop" in the coax, maybe 6" or so in diameter, by forming a 360-degree coil in the coax before routing toward the shack. Make this "loop" very close to the coax connector, preferably an inch or two away. Tape the loop in place so it will hold

its form, and then carefully route the coax towards the shack, never pulling hard on it. When installing the "drainage loop," make sure the loop itself is all *below* the antenna connector, with the turn of the loop facing down towards the ground. This will help prevent any moisture that happens to enter the connector from "wicking" down the coax and contaminating the whole length, so if you do have a water problem in the future it will be confined to the first few inches near the antenna connector. If this *does* happen, at least you'll have enough coax left up there to cut off the old connector and the few inches of contaminated coax, install a new connector and reattach it to the antenna. You won't have to replace the whole line.

How can I tell if my surplus coax is any good? I got a real bargain on it, but am afraid to use it until I test it somehow.

First, cut a few inches off each end of the coax to get a "fresh end" exposed. Then, cut away the outer jacket to expose the braid. Is the braid shiny? (It may be pure copper, tinned copper or silver-plated copper, but in all cases it should have a shiny, new finish

"When measuring, cutting and handling the cable, be careful not to create abrasion of the jacket."

and not be discolored, green or black.) Now, pull back the braid and look at the dielectric material. Does it have a new-looking, consistent color? (It may be white, off-white, translucent or nearly any color, but it should not be stained or discolored by the braid oxides or jacket plasticizers.) Now, cut back some of the dielectric and look at the center conductor. Is it shiny and new looking? (It may be pure copper, copper-plated, tinned, or silver-plated, but it should look shiny and new and not be oxidized.) If the answer to all these questions is, "Yes," then the cable is probably fine. But you may want to make an electrical measurement just to be sure.

If you have a good VSWR bridge or directional coupler of high quality, you can make two simple measurements. First, install connectors on both ends of the coaxial line. Next, connect your VSWR bridge at the transmitter end of the line with a short "jumper" and connect the TX end of the bridge to your transmitter. Then, install a "dead short" circuit across the far-end connector, which would normally go to the antenna. You can make a good short circuit that will be effective up to 144 MHz or so by using a piece of #12 copper wire and soldering it between the center and outer conductors of a mating receptacle. Keep the wire very short, under one-fourth of an inch long. (At frequencies above 144 MHz, a commercial short-circuit RF termination, usually type N, will work better. These are available inexpensively via surplus outlets.)

Now transmit, using the lowest possible power to obtain a reasonable reading on your VSWR bridge or wattmeter. Switch the bridge back and forth between forward and reflected ranges. The VSWR should read infinity, or close to it: Forward and reflected power will both be the same if the cable has minimal loss. The *difference* between forward and reflected power indications is the power lost in the cable, but remember this will be the power lost by the signal traveling both up and down the cable (to the short-circuit termination and back to the transmitter), so the attenuation in just *one* direction is one-half the difference between forward and reflected power readings.

For example, if you transmit with 5 watts of power and measure a reflected power of 2.5 watts, a total of 3 dB is lost by the cable when the signal travels to the termination and back again. The single-trip loss (signal traveling from transmitter to termination only) will be one-half this amount, or 1.5 dB. The dB loss is calculated as follows:

$$\text{Attenuation (dB)} = 10 \log_{10} \frac{P_1}{P_2}$$

Where P1 is the transmitter forward power (5W), P2 is the reflected power (2.5 W) and the attenuation is for a "round-trip" in the cable; the one-way attenuation, which is a more relevant parameter, is one-half this amount.

If you'd prefer not to intentionally transmit into a short-circuit (and some solid-state rigs won't let you, due to their internal VSWR protection circuitry), you can make a similar analysis by taking a few extra steps and using a good 50 ohm "dummy" load, as follows:

Connect your wattmeter to your transmitter using a short "patch" cable, and terminate the far end of the coax line with a high-quality 50 ohm (non-reactive) dummy load. Connect the TX end of the coax to the antenna port of the wattmeter, and transmit with as much power as possible to achieve a high-scale reading on the meter. Read this indication and write it down. Then, disconnect the wattmeter from the transmitter, connect the coax directly to the transmitter, and re-install the wattmeter at the far end of the coax, right next to the dummy load. Transmit again using the same power as before and record this reading. Subtract the lower reading (which should be the second one) from the higher reading, and calculate the one-way cable loss using the same attenuation formula as before (10 times the log of the power ratio). Using this method should yield exactly the same results as using the "return loss" method described earlier.

In the example set forth, where the cable has 1.5 dB loss, you might measure 25 watts at the transmitter and 17.7 watts at the far end of the line. The loss of 7.3 watts in this case is exactly 1.5 dB.

I tend to use the "return loss" method, with a very high-quality short-circuit termination, for most of my cable evaluations because it is simpler, and does not require in-

stalling the meter at each end of the line. But I also usually use a signal generator running very low power (like 10 milliwatts, which is +10 dBm) and a very good directional coupler in my system, so I'm not relying on transmitters and high-powered wattmeters. Attenuation in any cable is a fixed number at a given test frequency and will not vary with power applied, so my system yields very accurate results and is a quick way to check lots of cable.

As discussed throughout this article, there is more to know about coaxial cable than just how much loss it has. Its overall quality of materials and construction, resistance to the effects of weathering and UV radiation, flexibility, ease of use and other factors can be equally, if not more, important. Yet, attenuation (or loss) is probably the most important criteria for the majority of users and applications, especially if the load cannot, for some reason, be matched to the line and a high SWR results.

One last note on this subject: Do not be misled into thinking that SWR, or the match between your feedline and its terminating load, is any indication of *efficiency*. The two parameters—SWR and efficiency—are mutually exclusive. It can be proven that if your feedline loss is *zero*, it won't matter what the SWR is because 100% of all the power generated by your transmitter will be coupled to the antenna and *no* power will be lost.

Table 1. Coaxial Cable Data

Cable Type	Z ₀ Ohms	o.d. (in.V.F.)	Attenuation dB/100'					Dielectric
			50	144	222	440	1260	
RG58C/U	52	.195 66%	3.1	5.7	7.5	11	L9	PE
RG141A/U	50	.190 69.5%	2.1	4.0	5.2	7.6	16	TFE
RG59/U	73	.242 66%	2.4	4.2	5.4	7.8	14	PE
RG8X*	50	.242 78%	2.3	4.3	5.7	8.5	15	FPE
RG213/U	52	.405 66%	1.5	2.4	3.3	5.0	10.5	PE
RG11/U	75	.405 66%	1.3	2.4	3.2	4.9	9.5	PE
8214 Belden*	50	.405 78%	1.2	2.3	3.0	4.8	9.5	FPE
FM8 Times*	50	.405 80%	1.2	2.1	2.5	3.5	6.5	FPE
9913 Belden*	50	.405 84%	0.64	1.3	1.8	2.8	5.4	Air/PE
RG331/U*	50	.500 78%	0.60	1.1	1.5	2.4	4.0	FPE
RG17/U	52	.870 66%	0.50	1.0	1.3	2.3	4.4	PE
RG332/U*	50	.875 78%	0.35	0.65	0.80	1.3	2.5	FPE

Notes:

Cables denoted by an asterisk (*) are commercial cables and not qualified to any military specification.

V.F. = Velocity Factor of propagation. Not an important parameter unless cable is used in a tuned circuit, stub, trap or filter application or used as a precision phasing line.

Attenuation figures are plotted for 50 MHz through 1260 MHz only, as most cables have very little loss per 100 feet at frequencies below 30 MHz.

Dielectric type codes: PE = Polyethylene; TFE = Teflon; FPE = foam (cellular) polyethylene; Air/PE = helical dielectric of polyethylene and air.

Data taken by WB2WIK using 1000' lengths of each cable listed, measuring actual loss by "return loss" method, and dividing measured loss by 10 to calculate loss per 100 feet.

RG331/U and RG332/U are standard aluminum outer conductor "hardline" types which require specialized connectors. Used mostly for reference.

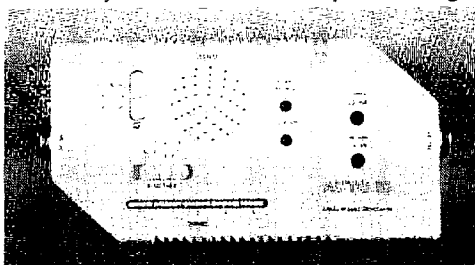
In my next article, I'll discuss the proper installation of coaxial connectors. To whet your appetite, I'll state now that *no* coaxial

connector will take more than 90 seconds to install exactly right if you're armed with the proper tools and knowledge. **73**

AUTO-ID AUTOMATIC MESSAGE BROADCASTER

The **AUTO-ID** is a solid state digital voice recorder that was developed especially for 2 way radios. It simply plugs in between the radio and its microphone. With the use of your radio microphone, you can record up to 5 separate messages that can be played on the air by pressing one of the 5 message buttons. The **AUTO-ID** also has a built-in timer that monitors your PTT (push to talk) activity. Record your station identification, and thereafter any time you are on the

air, the **AUTO-ID** will broadcast your ID message for you. The **AUTO-ID**'s message #1 timer can be set for intervals of 3 or 9 minutes or it may be set to broadcast your message



every time you use your PTT. With the use of the **AUTO-ID**'s built in speaker, you can monitor the message that the **AUTO-ID** is broadcasting, regardless of whether the selected message was broadcasted automatically or manually.

The **AUTO-ID** comes with plugs for an Alinco or Kenwood mobile amateur radio. There are accessories available to interface the **AUTO-ID** to most other types of radios.

FEATURES

- 12VDC power jack.
- Microphone patch cord (INCLUDED).
- 110VAC adapter (INCLUDED).
- Fully wired and tested, just plug it in.
- No soldering required.
- Built in local speaker.
- Adjustable speaker volume.
- Adjustable microphone level.
- Adjustable message broadcast time. (Message "1" only)
- Connects directly in line between radio and microphone.
- Pre-wired for Alinco and Kenwood Mobile radios.
- Power, Record and Play LED indicators.
- TX ready LED indicator.
- Timer enable/disable switch.
- All solid state construction.
- Up to 5 separate messages can be played individually.
- 32 seconds of total digital audio storage time.
- Simple to use.
- 1 year limited warranty.

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An *Almost* Everything Amplifier

Change from 7 MHz to 225 MHz with no bandswitching or tuning!

by John Cunningham AA4AW

There are times when you need more power to get into a repeater or to be heard across the country. People who operate handhelds or QRP sometimes find that they have a hard time communicating with such limited power at their disposal. However, buying an amplifier for 10 meters, another for 6 meters, another for 2 meters, and still another for 1.25 meters can get expensive. Wouldn't it be nice to have an amplifier that took care of all these bands?

The amplifier described here meets these requirements. It is broadbanded from 7 to 225 MHz—the range of 10 amateur bands (40, 30, 20, 17, 15, 12, 10, 6, 2, and 1.25 meters). It will operate on CW, SSB, AM, and FM—or any other mode that is used on these frequencies. It can be fed with an input of 1/10 to 24 watts (though there is not much gain above 12 watts input) and can deliver an output of more than 200 watts. It can be operated over a voltage range of 12 to 28 volts.

Field-effect transistors are more immune to damage from high SWR and thermal runaway than bipolar transistors. They also have higher gain, greater efficiency, and lower noise. They can be operated over a greater voltage and power range than bipolar transistors.

The MRF175GV is a Gemini twin which means it is two balanced transistors in one package. The amplifier designed here will not work unless the transistors are balanced.

Field-effect transistors have a few draw-

backs. They are more prone to static damage, and care must be exercised during handling until they are soldered onto the board. They easily go into oscillation, owing to their high gain. Be careful not to drive them too hard and destroy the gates. If there is a chance of this happening a limiting circuit should be installed at the input of the amplifier.

Collecting the Parts

The MRF175GV field-effect transistor can be ordered from RF Parts (telephone: 1-800-737-2787 or 619-744-0700). The transformers, chip caps, and copper heat spreader are available from Communication Concepts, Inc. (hereafter referred to as CCI) at 508 Millstone Drive, Xenia, Ohio 45385 (telephone: 513-426-8600). Experimenters who plan to use a similar design in future projects should purchase the coax needed to make the transformers instead of buying them fully assembled. CCI will not send less than five feet of the coax in any one shipment. Five feet is enough to build five output transformers and almost 10 input transformers. However, once you go this route you must also buy the ferrite beads that accompany the transformers.

The total cost of this project is about \$362, but that doesn't seem so high when you consider that many of the parts must be ordered in more quantity than is necessary for this project, and the excess can be used on future ventures. The copper heat spreader, for instance, can be cut into three pieces and used

in two other projects. Also remember that a high percentage of the cost is in the transistor at \$154. If this sounds expensive, consider that to get 200 watts from commercially-built amplifiers you usually pay more than \$200, and most of these amplifiers are single-band! Multiply \$200 by the 10 amateur bands that this amplifier covers and you get a whopping \$2,000—far more than the cost of this amplifier. Maybe you will not work all 10 of the amateur bands which this amplifier will handle, but if you are an experimenter you probably will.

Construction

I used a Radio Shack 276-1499 circuit board and cut it to the proper size. A single Radio Shack card will build two of these amplifiers. This design consists of two separate cards: one for the input and one for the output. The cards are cut to a size that will enable them to fit into a Radio Shack aluminum box (no. 270-238) 5-1/4" x 3" x 2-1/8". The output card should be cut to 2-3/4" x 2-11/16". The size of the input card should be 2-11/16" x 1-3/4". (Custom pre-etched circuit boards for this project are available for \$7 a set plus \$1.50 S & H from FAR Circuits, 18N640 Field Court, Dundee IL 60118.)

A copper heat spreader is cut to a size that will allow it to fit into the box and enable the lid of the box to fit over it: 5-1/16" x 2-11/16" will make the proper fit.

You will need to drill holes into the boards, box, heat spreader, and heat sink to mount the hardware that holds these devices together. These holes must be lined up with the holes drilled for the circuit board, except that the rectangular holes will not be made in the heat spreader, box, or heat sink. You will also need to drill holes for the bolts that hold the transistor in place. See Figures 2 and 6.

In addition, you will need to make inserts in the circuit boards and the heat spreader (See Figures 2, and 6). I used a grindstone to make the inserts. Without the inserts, the connectors will not fit on the sides of the box.

Holes should be drilled on the output board to bond the ground on the component side of the board. (See Figure 2.) Once the holes are drilled, a lead from a resistor or other component can be placed in the holes and soldered to both sides of the board.

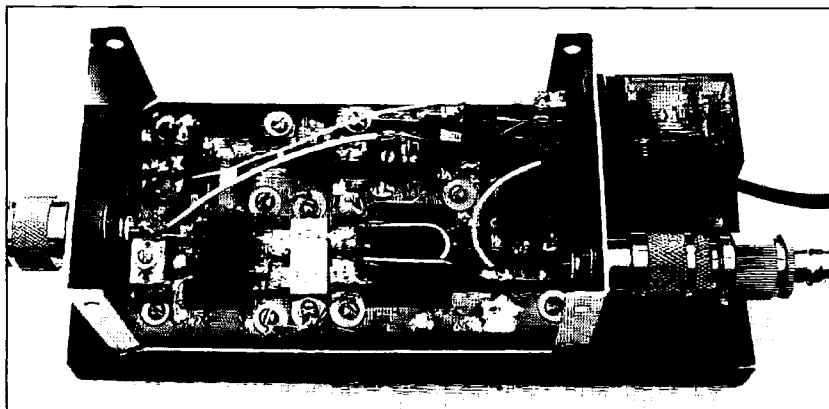


Photo A. The multi-octave amplifier. Photo by John Cunningham AA4AW.

I used Radio Shack 276-1435 etchant, according to the instructions printed on the etchant bottle. Only one side of the board will be etched, except for a little on the lower side of the output board where the power transistor will be. See Figure 2. I drew the pattern with a felt pencil which left the copper to be etched, except for a little on the lower side of the output board where the power transistor will be. Sec Figure 2. I drew the pattern with a felt pencil which left the copper to be etched, except for a little on the lower side of the output board where the power transistor will be. The unetched copper was further protected by duct tape. All components are located and soldered on one side of the board, similar to a ground-plane configuration—the difference being that some etching is done. This design makes for improved grounding and ease of troubleshooting, repair, and modification.

Once the circuit boards are etched, components can be soldered in place. The component layout is not critical, except that capacitors C5 and C6 must be soldered before transformers T1 and T2 are put on the boards. I recommend that you don't place these transformers on the boards until the boards are bolted inside the box and the ferrite beads are put in place. Otherwise, the parts placement is according to Figure 3. I recommend using only chip caps because the leads from other types of capacitors may pick up stray RF and make the amplifier inoperable.

The most difficult part is assembling the transformers. If you order from CCI specify that you want a low-impedance input transformer and a high-impedance output transformer with a 1:9 ratio. CCI does not sell low-impedance input transformers with a 4:1 ratio as called for in this design, but you can order a 9:1 impedance input transformer and convert it to a 4:1 transformer by removing one of the windings. Otherwise, assemble the transformers according to Figures 3 and 4. If you order the coax to build the transformers yourself, specify that you want both input and output coax; they are not the same.

For use at frequencies below 100 MHz, ferrite beads must be put on the input and output transformers to control parasitic oscillations, thereby increasing stability. See Photo A and Figure 4. These oscillations can get so bad that they destroy the transistor in-

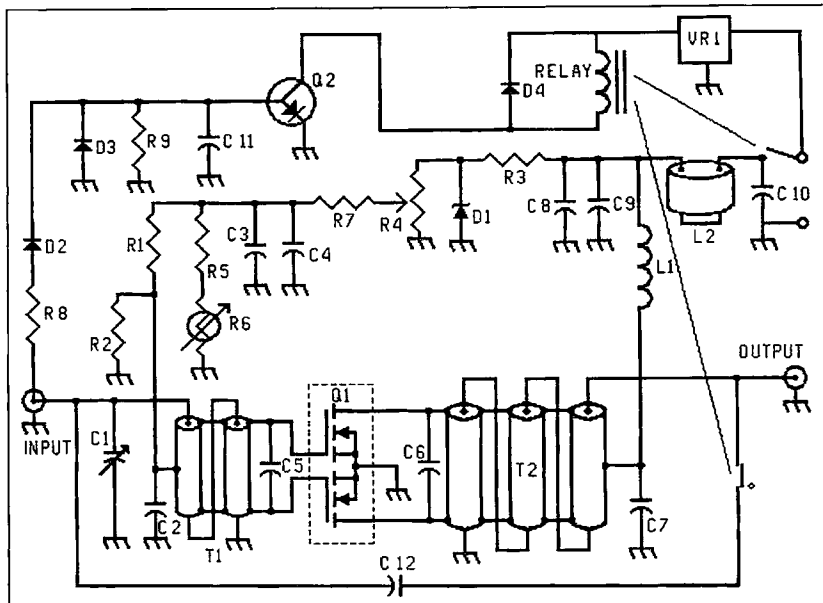


Figure 1. Schematic for the MRF175GV amplifier.

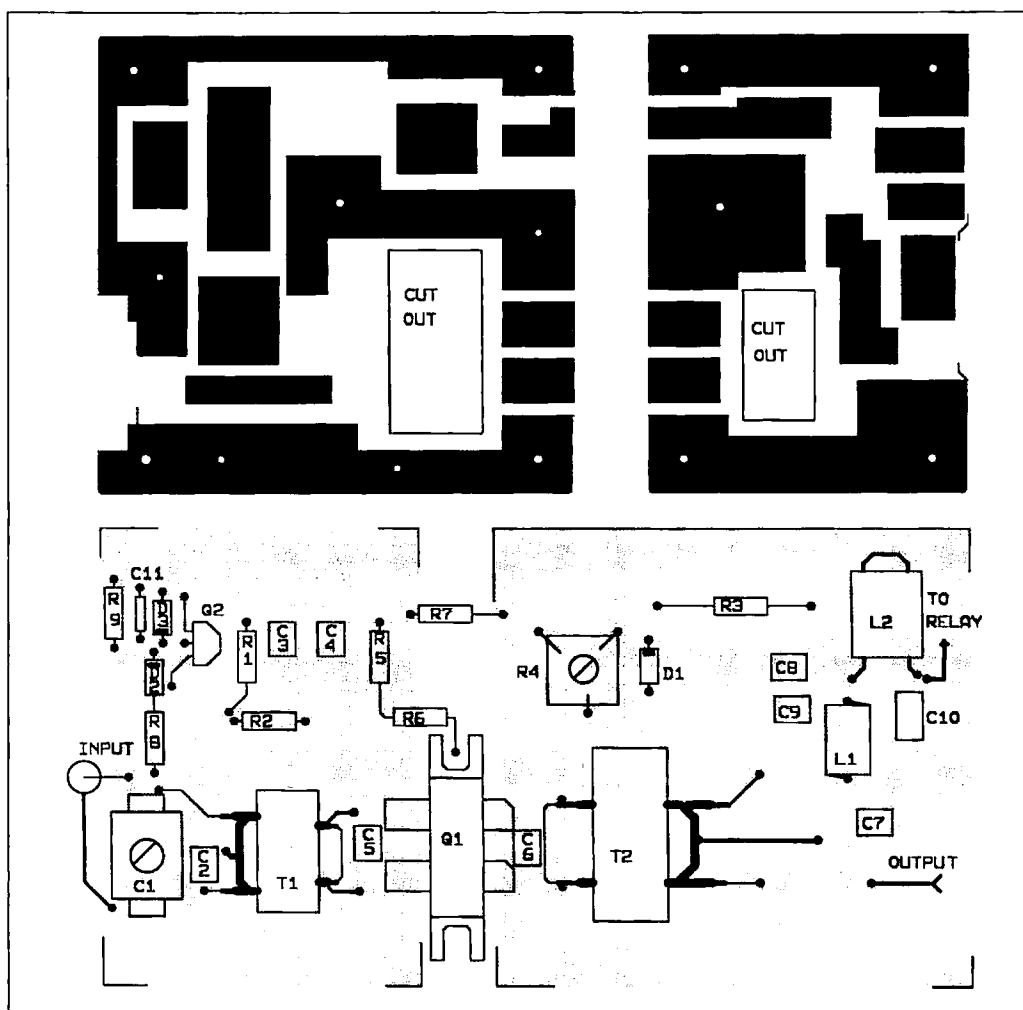


Figure 2. Circuit board.

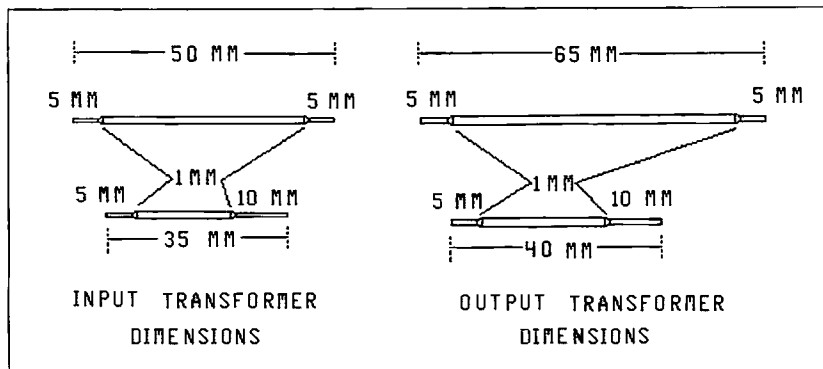


Figure 3. Preparation of the transformer coax. Cut the transformers to the lengths shown, and strip the outer conductors. The inner leads that are to be 5mm should have their outer conductors stripped 6mm and the leads that are to be 10 mm should be stripped 11mm. Then strip the insulator that goes between the inner and outer conductors, leaving 1mm of insulator as shown, which will leave the inner conductors bare at the proper lengths.

stantly—especially when operated with more than 20 volts on the drain. If you intend to use the amplifier exclusively above 100 MHz, the beads can be left off the output transformer to get greater efficiency. In addition to stabilizing the amplifier, these beads can also aid in heat dissipation—something that is critical if the amplifier is to be operated at its maximum power. As for putting beads at the input transformer for use above 100 MHz, they should be installed if the am-

plifier will be operated at more than 20 volts. For operation below 20 volts, generally more power is obtained from the amplifier if they are left off—especially at frequencies above 200 MHz. However, the amplifier is more broadband if the input beads are left on.

Instructions for installing the beads are included if you order them from CCI. I used only a weak kind of glue, such as a little dab of silicone rubber, to hold the E ferrite beads to the I beads because I anticipated taking

them off. The input E bead ordered from CCI fits the 9:1 transformer they sell but is a bit large for a 4:1 transformer. Therefore, I filed down the E bead until it made a tight fit. The I beads need to be glued to the heat spreader after the circuit boards are installed, but before the transformers are soldered to the circuit boards.

A rectangular hole needs to be made in the output side of the box for the relay. If you do not have the tools to cut a square hole you can drill several small holes inside the area of the opening. Then use a hacksaw to further cut the area into straight sides. I deliberately made the cutout smaller than the dimensions shown because I did not want the relay socket to fit too loosely. In order to have a tight fit, I used a file to gradually increase the opening to the dimensions necessary for the relay socket. See Figure 5 for the positioning of the relay and the input and output connections.

When the box and circuit board have been properly prepared you are ready to assemble the amplifier. The heat sink, box, and heat spreader fit flush together; they should be sanded to eliminate burrs. Thermal heat sink compound should be applied between these parts as they are placed together. I used Radio Shack 276-1372 compound for this project. However, no thermal compound should be put on the circuit boards, which are raised above the heat spreader by means of washers (see Figure 6). The leads of the power transistor will need to be bent sharply upward—especially the output (drain) leads. Separating the boards from the heat spreader reduces heat on the components on the boards. It also makes the transformers fit flat on the boards when ferrite coils are used, instead of being elevated above the boards as they would be if the circuit boards were not elevated from the heat spreader.

The heat sink, box, heat spreader, and circuit boards are bolted together, using five bolts for each board. See Figures 2 and 6. I recommend that you don't tighten the bolts holding the boards in place until the transistor is bolted securely.

The power transistor should be placed on the board next. Use care in handling a field-effect transistor as these devices are subject to being destroyed by static buildup. When handling FETs, pick them up only by their sources. It is a good idea to wear a grounded wrist strap and to work on a static-free table using a grounded soldering iron. Once the device is soldered in place the danger from static buildup is minimized.

The transistor is mounted between the two circuit boards on the copper heat spreader. Thermal heat sink compound must be used when mounting the transistor. Be careful not to mount the transistor backwards—that's easy to do. The two flanges that have one of their corners cut are the drains; the other two are the gates. The leads on the output side of the transistor are bent sharply upward, but be careful not to break them. Also, there is a chance of the output leads shorting to the unused side of the board. One way to prevent

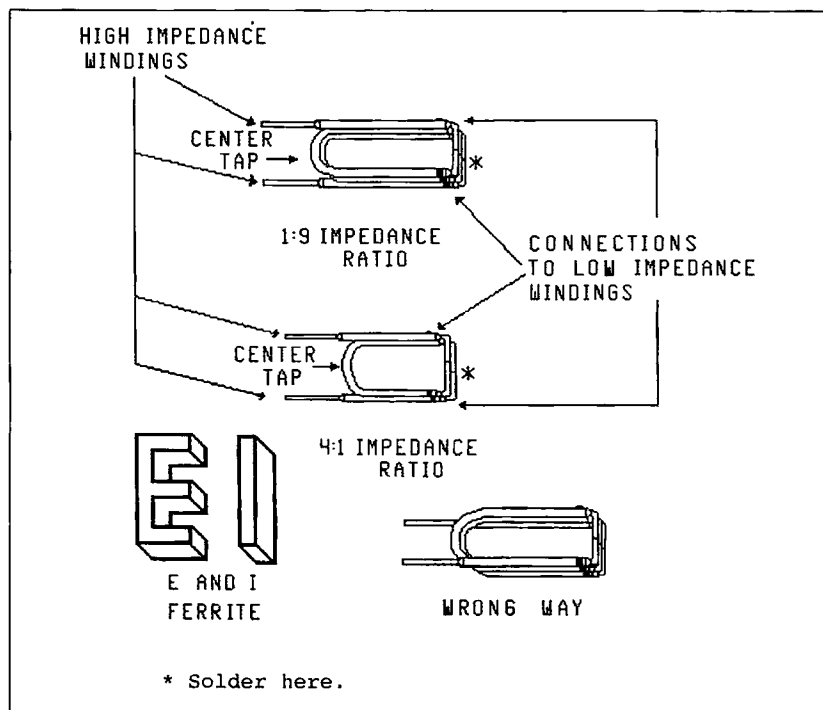


Figure 4. Preparation of the transformers. The leads between the transformer windings should be as short as possible. Bend the coax and bend the leads till they touch tip to tip, and solder the tips together. When properly assembled, an ohmmeter check will show a closed circuit between the two ends of the transformer leads and an open circuit between the inner and outer conductors. The mistake made on the bottom right drawing is easily made by persons assembling the transformers themselves. Nothing feels worse than getting the transformer assembled and having to redo it.

this is to etch away a small part of the output board near the transistor. See Figures 2 and 6.

Once the transistor and circuit boards are mounted and their bolts tightened, solder the flanges to the transistors. The transformers can be positioned now and soldered, completing the installation of the circuit boards. Then the last of the components can be soldered in place—VR1 and C12—as well as the connective wires for the receive circuit and the wire that provides the power for Q2. See Figure 5.

Before applying voltage, it is a good idea to do a few continuity checks. See if there is zero resistance from the voltage input to the drain of the transistor. Then check for shorts between the drain and ground and between the gate and ground. If you find shorts, do not proceed until the trouble is corrected. Both the input and output, however, should have a short to ground.

Checking It Out

When the resistance checks are made, you are ready to test the amplifier. Connect the input to a handie-talkie or other low-power transmitter and the output to a dummy load that has some kind of power indicator. If you have a spectrum analyzer, so much the better. A dummy load wattmeter will do—so will a dummy load with an SWR and relative power indicator placed between the amplifier and the dummy load. Be sure the dummy load is capable of handling more than 200 watts.

When applying voltage, put no more than 12 volts to the amplifier at first. Once voltage is applied, quickly check the voltage on the gates. This voltage will vary, depending on the adjustment of R3. For now, adjust R3 until the gate voltage reads approximately 2 volts. The gate voltage should not exceed 6 volts.

If you wish, you can check out the amplifier portion of the project before you check out the receive portion. To do this, do not connect one side of R10. However, once the amplifier is tested and R10 is reinstalled, it will have to be realigned.

Once the voltage on the gate is 2 volts, ap-

Parts List		
C1	Arco 404 mica trimmer, 8-60 pF or equivalent	Available from CCI.
C2, C3, C7, C8	1000 pF chip	CCI no. C1210C NPO 200V
C4, C9	0.1 mF chip	CCI no. C1813 BX 100V
C5	200 pF chip	ATC 100B 300V
C6	In parallel: 100 pF chip 130 pF chip	CCI no. C1210C NPO 50V ATC 100B 500V
C10	.47 mF chip	CCI no. C2225 BX 100V
C11, C12	.001 mF PC mount capacitor	Radio Shack 272-126 (or equivalent)
D1	8.2 volt zener	1N5923A or 1N756A, available from CCI.
D2, D3, D4	1N4148 high-speed switching diodes or equivalent	Radio Shack 276-1112 (for 10 diodes) or 276-1620 (for 50 diodes)
L1	10 turns AWG # 16 enamel wire, close wound, 1/4" i.d.	
L2	CCI VK 20/4B RF choke or ferrite beads of suitable material for 1.5—2 mH total inductance.	
Q1	Motorola MRF175GV	
Q2	2N4401 NPN transistor or equivalent	
R1	1k 1/2 watt	
R2	10k 1/2 watt	
R3	330 ohm 2 watt	
R4	1k variable trim resistor	CCI 3386P-102 or equivalent
R5	6.8K 1/4 watt	
R6	10k (25C)-2.5K (75C) thermistor	
R7	2k 1/2 watt	
R8	100 ohm 2 watt	
R9	10k 1/4 watt	
Relay	12 volt DPDT, 15 amp contacts	Radio Shack 275-218 and 275-220 relay socket.
T1	4:1 impedance ratio RF transformer. Can be made of 25 ohm semirigid coax, 47-52 millimeters outside diameter.	
T2	1:9 impedance ratio RF transformer. Can be made of 15-18 ohm semirigid coax, 62-90 millimeters outside diameter.	
NOTE: Both T1 and T2 are available from CCI. If you don't buy the transformers fully assembled you will need magnetic cores for the transformers. For T1 use Fair-Rite Products Corp. #9461012002/9361021002 E (or type 75-26 E and 1 Micrometals powdered iron core). For T2 use type 100-8 E and 1 Micrometals powdered iron core). See text.		
VR1	12 volt regulator	Radio Shack 276-1771
Connectors	Type N chassis mount female	Radio Shack 278-152 (or equivalent)
Optional	Radio Shack auto cigarette lighter power cord	#276-021
Circuit boards for this project are available for \$7 plus \$1.50 S & H from FAR Circuits, 18N640 Field Court, Dundee IL 60118.		

ply a 0.5 or 1 watt RF signal to the input of the amplifier. The relay should click on. If it does not, adjust C1 until it does. If the relay still does not come on, there is either a component breakdown or an error in construction. Once the relay has engaged, see if there is any output indication. Adjust capacitor C1 and R3 for maximum output. One good feature of this amplifier is that there are only two adjustments to be made: C1 and R3.

All this sounds simple, and it usually is. However, these amplifiers have a tendency to go into oscillation. Turn off the exciter, and

see if you still get a power indication on the wattmeter. If so, the amplifier is oscillating. Back off from R3 until the oscillation stops. C1 may also be adjusted. The trick is to get the maximum power out of the amplifier without it going into oscillation and remaining in that state after the drive has stopped.

When properly adjusted, the amplifier should give out more than 30 watts at 12 volts with 1 watt drive. At this point, you can increase the power of the amplifier by gradually applying more voltage to the drains. Never exceed 28 volts on the drains, and never let the voltage on the gates exceed 6 volts—if even that much.

If you are content to use only 14 volts (the power available in most automobile electrical systems), the amplifier can be used for continuous duty operation on all modes. At this voltage the transistor can withstand infinite SWR and any other conceivable abuse (except overdriving) and should easily outlast its owner. Notice that the amplifier gets warm after only a few minutes—even at this power level.

A word of caution: Some late-model automobiles are equipped with computers that will break down if a transmitter putting out more than 10 watts is used. This can stop the engine and lead to a thousand-dollar repair bill. Check your automobile owner's manual.

Once the transmitter is functioning, you are ready to test the receive circuits. Since the receive circuit consists of nothing more than a relay and capacitor C12, there should

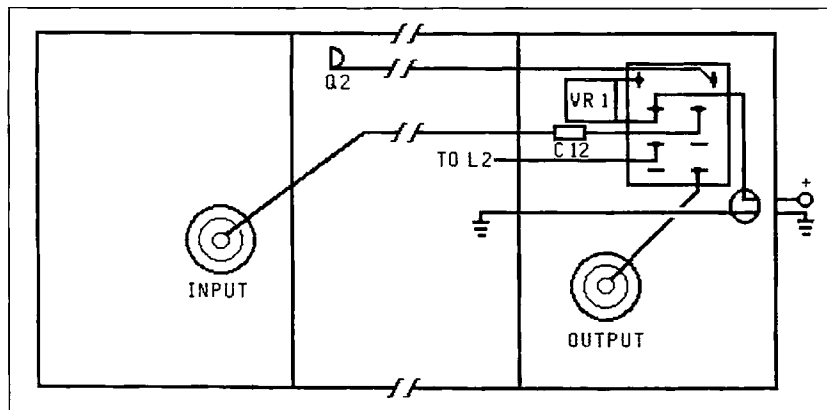


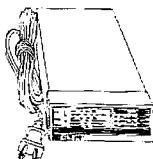
Figure 5. The front and back sides of the box, showing the relay mounting and relay connections. The hole near the relay which allows DC into the box should be approximately 1/4" diameter. The rectangular opening for the relay should be 1" by 7/8". The holes for the "n" connectors should be 9/16".

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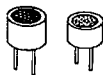
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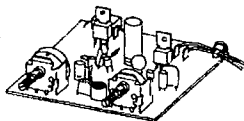
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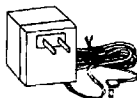
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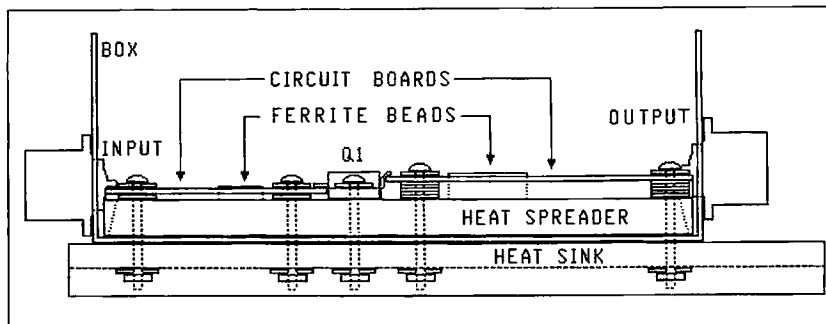


Figure 6. Bolting the amplifier parts together. Note that the flanges of the output of the power transistor have to be bent upward. The output of the transistor can short to the bottom of the circuit board unless a small part of the bottom of the board is etched. See Figure 2.

Be careful to make the input and output connectors touch on the circuit board, or the amplifier may not work at 225 MHz. Solder the inputs and outputs directly to the foil of the board without using lead lengths. A BNC connector could be used in place of the type N connector used in this experiment.

be no problem if everything was installed correctly.

How It Works

When an RF signal is put into the amplifier, a small portion of it flows through R12 and D2 (see Figure 1), which turns on Q2. This action causes the relay to engage, thereby disconnecting the receive circuit and allowing voltage from the power supply to enter the amplifier.

Resistors R1 through R7 supply the proper

bias voltage to the gates of Q1. The power supply voltage goes to the drains through the T2 center tap.

The transformers are wound in such a way that they match the 50 ohm impedances of the input and output over a range of several octaves. The transformers' ratios are the ratios of the square of their turns. For instance, one turn would give a 1:1 ratio, two turns a 1:4 ratio, three turns a 1:9 ratio, and four turns a 1:16 ratio.

Continued on page 42

Number 9 on your Feedback card

HAM HELP

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS 73 MAG Message Area #4. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Use upper- and lower-case letters where appropriate. Also, print numbers carefully - a 1, for example, can be misread as the letters l or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

transceiver. Photofacts preferred. I will pay for copy and postage. Brent Putnam N8UBD, 12110 Mayfield Rd. #6, Cleveland OH 44106. E-mail on college internet bwp2@po.cwru.edu.

Needed: Schematics, Parts/Track Maps and Component Location Diagrams for Genave Alpha/500 Nav/Com. I want to use the receiver for 121.5 MHz ELT locator. I will pay reasonable costs. Thank you. Lewis Moore N4DRJ, P.O. Box 52, Cornelia GA 30531. (706) 778-4716.

Wanted: Information on satellite operation: How to get started, uplink/downlink frequencies, telemetry info, equipment needed, antennas, etc. Can anyone suggest a good up-to-date reference source that can give me complete information? Also, I am interested in contacting hams who are vegetarians (for recipes and ideas). Contact me on the local Spokane WA 147.20 rpt, or write to: Doug Cole N7BFS, P.O. Box 72, Spokane WA 99210.

Needed: Manual/schematic, or copy, for Zenith Color Monitor, Model ZVM131, Service No. CD13MVR005. Ed Reichert N2BGE, 462 Timberline Dr., Mt. Laurel NJ 08054.

I am in need of the schematic and/or SAMS Photofacts for the HyGain II CB

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An Experimenter's Power Supply

An adaptable multi-voltage supply.

by Fred Reimers KF9GX and Mark Reimers

After you have built a special project and want to power it up, you connect the completed project to your power supply. But what do you do when the project requires special voltages, different from the normal 12 VDC power supply, like +9 and +5 and -5 and -9 VDC? You say to yourself, "I need a multi-voltage power supply that also has negative voltages, and I have to be able to set the voltages to accommodate different projects."

Switching Supplies vs. Standard Transformer Power Supplies

There have been a number of articles on power supplies over the past years. Most of these have been single- or dual-voltage.

Switching power supplies have a lot to offer. They provide higher efficiency at higher currents than transformer supplies. Switching supplies are smaller and weigh much less than transformer supplies. An 8-amp transformer supply could weigh six to 10 pounds, while a switching supply could be as light as two pounds. Switching supplies are easier to filter and offer better regulation.

Why haven't there been published construction articles on switching power supplies? Because switching power supplies are much harder to design and it's difficult to keep the radiation down. Without a large amount of RFI filtering and shielding, you could never operate a radio near a switching power supply.

Switching power supplies are not as reliable as conventional transformer power supplies, though the commercial supplies are becoming as reliable as their transformer counterparts. The weakest links in switching supplies are the switching devices (transistors or FETs), due to the dI/dt transients un-

der load conditions. The biggest reason why standard transformer power supplies are still popular with us builders and experimenters is the availability of parts and the ease of building a supply. With the availability of transformers, regulator ICs (ie. the 723, 78xx series and 317/337 devices), and capacitors, it is easy to build a transformer power supply.

We wanted to make a supply that was simple, yet versatile enough to fit all low power multi-voltage applications. The supply we came up with has six outputs that can be independently adjusted. We set the outputs to +12, +9, +5, -5, -9, and -12 VDC.

"The biggest reason why standard transformer power supplies are still popular with us builders and experimenters is the availability of parts and the ease of building a supply."

Circuit Description

The power supply is made up of two independent circuits, the positive and the negative voltage sections. Diodes D1-4 and D5-8 rectify the AC voltage and C1 and C2 filter the DC voltage for the positive and negative sections. Capacitors C3, 5, 7, 9, 11, and 14 are placed at the input of each of the regulator ICs for regulator stability; C4, 6, 8, 10,

12, and 13 are placed at the output of each regulator for improved transient response, i.e. to improve the output voltage overshoot and undershoot response when a load is applied or removed from the output. The negative and positive sections are divided into three separate regulator circuits. The LM317T and LM337T regulator ICs, chosen because of their availability, require only two external parts, can be configured as variable regulators, and are rated at 1.5 amps (with proper heat-sinking). The voltage adjust resistor was chosen as 5k, but lower values could be used to increase the adjustment sensitivity and to lower the maximum adjusted output voltage.

The data book (Note 1) gives the equation for the output voltage as:

$$V_{out} = V_{ref} (1 + R2/R1) + I_{adj} R2$$

V_{ref} is a constant 1.25 volt that is maintained between the output and adjust terminals by the regulator. Thus, the lowest voltage that can be achieved from the LM300 series regulators is 1.25 volts. Using the above equation, the adjustable resistor value is 2,244 ohms for a 13.8 volt output. Using a 1k pot would yield an output voltage range of 1.25 to 6.8 volts. Depending on where the output voltage of the individual regulator is set, the LED current-limiting resistor should be adjusted to keep the LED current in a safe operating range, as specified by the LED manufacturer. We like to keep the LED current between 10 and 20 milliamps.

To calculate the LED current for the output voltage setting you want, use the formula:

$$R_{LED} = (V_{out} - 0.7) / 0.015$$

The 0.7 is the LED voltage drop and 0.015 is the LED current of 15 milliamperes. For example, for V_{out} of 12 volts, the current-

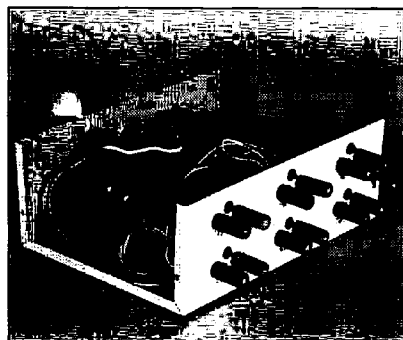


Photo A. The experimenter's power supply.



Photo B. The completed circuit board.

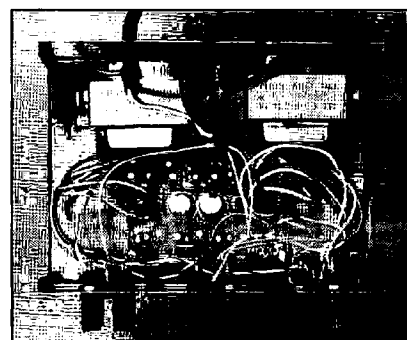


Photo C. Bird's-eye view of the circuit board and transformer placement.

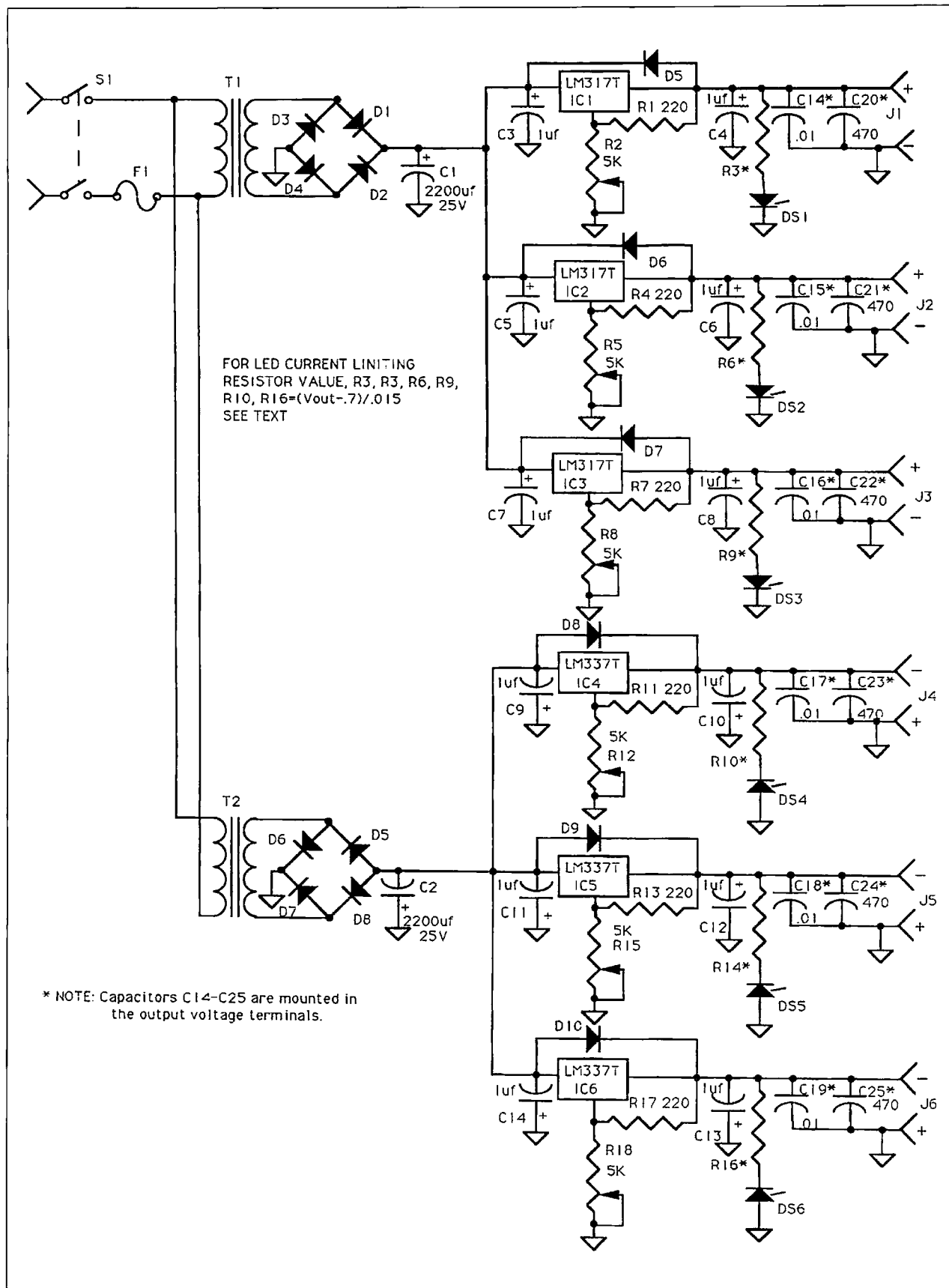


Figure 1. Schematic for the switching power supply.

limiting resistor should be 750 ohms. A 680 or 820 would also work, keeping the current in the 13.78 to 16.6 milliamperes range. For a lower value of V_{out} of 5V, a 270 or 330 ohm resistor will do the job. We used a 680 ohm LED current-limiting resistor. This kept the LEDs in a safe operating limit at the higher voltages and still allowed the LED to light dimly when the output voltage was adjusted to 5 volts.

We chose a 3 amp transformer because of its availability and current rating. The available 3 amp source current is divided between the three regulator circuits. Two separate transformers were used for the AC to keep the positive and negative voltages isolated. We mounted the transformers off the PC board.

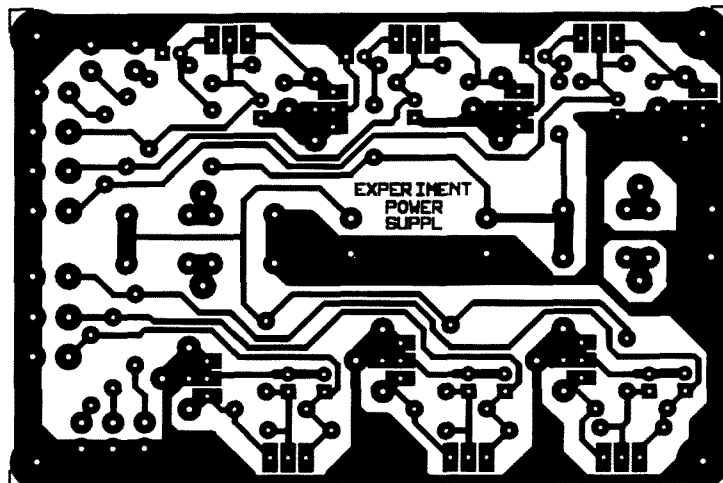
A Word About RFI

All active regulated power supplies work great until you use them to power up the transmitter project you just finished. Have you ever wondered why the voltage drops or increases drastically when you key the transmitter? This is due to RF getting back into the regulator of the power supply. To prevent this, put 0.01 and 560 pF or 470 pF capacitors across the voltage output terminals.

A word of caution: The LM317s and LM337s like to have a load on them at all times. If the LEDs are not installed, and with no load on the regulator, the output voltage could float up to the input unregulated voltage. The LED current is sufficient to keep the output voltage from floating up.

Construction

The project is assembled in a Radio Shack box #270-250. A bigger box may be required if heat sinks and/or front panel adjustments are used. The AC power switch should be a DPDT type which disconnects both sides of the line when the power supply is turned off. The fuse should be in the high side of the power line and use a three-prong AC plug on the end of the power cord. The regulator ICs are rated at 1.5 amperes but will require heat sinks for the lower voltage applications that draw more current. For example, if the output is adjusted to 5V and the load current is 0.75 milliamps, there will be almost 10 watts of power dissipated into heat in that regulator IC. We did not show the heat sink in the power supply pictured in this article. When adding the heat sink, remember that the tabs on the LM337Ts are connected to the input voltage and the tab on the LM317T is connected to the output voltage. Mica insulating hardware (such as Digi-Key 4671K-ND or 4672K-ND, or Newark 46F7847 with insulating shoulder washers) must be used to isolate the tabs of the regulators from each other. The power supply is assembled on a nice 4" x 2.75" PC board with a screened legend for easy assembly. The board is available from FAR Circuits (Note 3). The transformer is external to the board and connects to the T1 and T2 points on the board.



73 Review

by T.S. Rowinski KAIMDA

The ICOM IC-W2A Dual-Band Handheld

Two radios in one!

ICOM America, Inc.
2380 116th Ave. N.E.
Bellevue WA 98004
Telephone: (800) 999-9877
Price Class: \$500

It never failed. No matter which rig I happened to have at any given moment, all the action seemed to be on another band! If I had my 2 meter HT, I would miss my normal commuting skeds on 440 MHz. Yet whenever I had my 440 MHz HT with me, I would always find some need to get on the more heavily populated 2 meter band. The thought of carrying around the extra weight of two full-size handie-talkies and a couple of heavy-duty battery packs was not an appealing one.

There was only one solution: It was time to upgrade to one of those new, compact, dual-band handhelds! Having had excellent results (with both performance and service) with my older ICOM HTs, I selected the ICOM IC-W2A.

The ICOM IC-W2A is a full-featured dual-band handheld measuring only 6.7" high, 2.1" wide, and 1.4" thick. The rig weighs in at only 1.2 lbs. As delivered, frequency coverage is 140-150 MHz and 440-450 MHz transmit, 136-174 MHz and 440-450 MHz receive. Despite its small size, the W2A offers a full 5 watts output (at 13 volts) on both bands, four scanning modes, 60 memories (30 per band), simultaneous receive on both bands, full crossband duplex operation, and a host of other functions. Unlike many other HTs, the W2A comes equipped with a heavy-duty 7.2 volt, 1,000 mAh battery pack and a multifunction PL encoder/decoder as standard features. Other noteworthy features include a 24-hour clock, power on/off timer, two power-saver modes, four 15-digit autodialer memories, and a pager mode.

Although I had seen photos and dimensions of the HT prior to ordering the rig, they still did not prepare me for the surprise I experienced when I opened the box. How could ICOM fit all those features into such a small package? Although the W2A may sound large due to its 6.7" height, the heavy-duty BP-84 battery pack takes up three of those inches; the actual radio itself is only 3.7" long! The antenna connector, speaker and mike jacks, external power jack, rotary tuning knob, and dual concentric volume/squelch knobs are placed on top of the transceiver. An LCD display shares the front panel with the internal speaker/mike, an RX/TX status indicator LED, and no less than 22 individual buttons—no small feat considering the W2A's 6.5-square-inch front panel. The function and

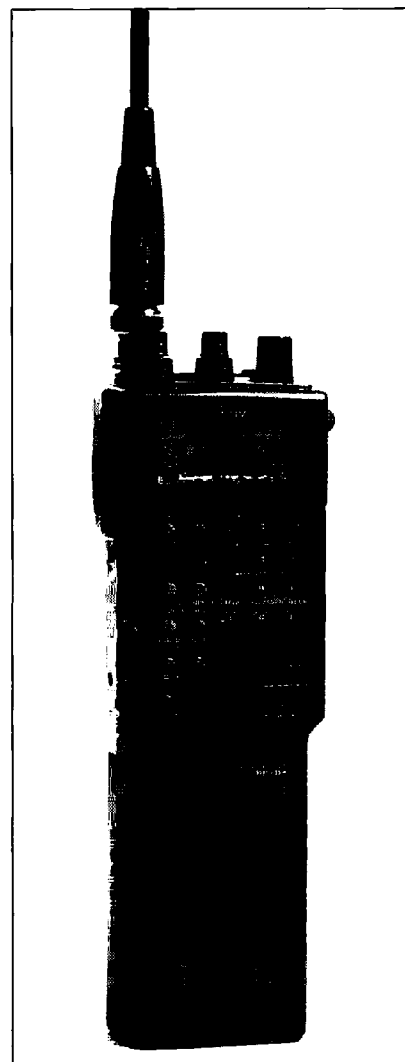
PTT switches are located on the left side of the case. The lower two-thirds of both sides of the case are contoured for an easy and comfortable grip.

The first thing I noticed about the W2A is how naturally it fits in the palm of the hand. After using this HT for a few hours, going back to my trusty O2AT/O4AT suddenly felt as if I were holding a brick! Although the W2A is compact, it does not feel cheap. The rig has a slightly heavy (for its size) feel, and the metal back provides structural rigidity while serving as a heat sink for the output modules. Squeezing the rig, even hard, caused none of the squeaking, popping, or snapping sounds common to many plastic-cased radios. The W2A felt like a quality, high-grade piece of electronic gear.

Features

The ICOM W2A is chock-full of useful features. There are 30 memories, plus a VFO memory, call channel memory, and two band-scan memories for each band. Each of these is capable of storing not only frequency and offset, but custom offset, PL encode mode and frequency, PL squelch mode, and channel scanning lockout information as well. Unused memories can be masked. Memory backup is handled by an internal rechargeable battery, although ICOM provides no information as to how long memory contents can be retained with no external power.

There are five different scan modes available. The simplest is VFO scan mode. Enter a frequency into the VFO memory, and hit the scan up or scan down key. This has the same effect as tuning a receiver across its tuning range. Programmed scan mode allows the user to enter two frequencies into scan memory, and the radio then scans continuously between these two limits. This is similar to what scanner manufacturers call search scan. Memory scan mode scans all 30 memories, regardless of their lockout or "skip" settings. Memory skip mode scans only those memories which have not been assigned lock-out status. Finally, frequency skip mode allows the user to enter up to 20 frequencies in memory, and perform a VFO or programmed band scan. The rig will then ignore these frequencies while scanning. If this weren't enough, all these modes have two resume modes: timer and pause. Timer resume



stops the receiver when a signal is received, pauses for five seconds, and resumes scanning. Pause resume mode stops the receiver when a signal is received, and will not resume scanning until two seconds after the signal ceases.

The ICOM W2A also comes equipped with a multifunction PL board which allows full PL encode/decode functions. The PL unit can be used not only as an encoder to access closed

repeaters, but also as a subaudible tone squelch which will keep the receiver squelched regardless of channel activity until the unit receives the proper PL tone. When the right tone is received, the W2A can be set to either open the squelch and receive the signal, or to emit a series of pager-like beeps for 20 seconds. Pushing the PTT button cancels the PL alarm mode and returns the rig to PL tone squelch mode, allowing reception of the desired signal.

When setting PL tones, the actual tone frequencies are displayed on the LCD, instead of the archaic two-digit alpha-numeric codes used on some older rigs. Since the PL board is actually two units in one, it's possible to transmit with a PL tone on one band and activate the PL squelch on the other band using a different PL tone. It is also possible to operate both receivers in PL squelch mode using different tones on each band. Although the PL tone squelch functions during crossband repeat mode, the PL encoder does not.

The W2A also sports a pager/code squelch mode which is activated by a sequence of DTMF touch-tones. This mode allows for all call, group call, and individual call modes, which allow a single transmission to trigger all receivers, a subgroup of receivers, or a single receiver, respectively. The pager tone sequences, as well as the pager decoder codes, are entered into five memory positions reserved for this function.

Other nice touches include tuning increments which can be set at 5, 10, 12.5, 15, 20, 25, 30, and 50 kHz steps for both VFO and scan modes. In addition to these, 100 kHz and 1 MHz steps are available when using the tuning knob at the top of the radio. Frequencies can also be input directly from the keypad. Transmit offset frequency is programmable in 5 kHz steps from 5 kHz to 10 MHz. The IC-W2A also features a keyboard lock function which locks out all keys except the dial light and high/low power switch, and a PTT lock which makes it impossible to key the transmitters.

A number of features specifically address power consumption and battery life. Transmitter power output is selected from four steps rather than the more common hi/low setting. "Auto off" mode shuts off the radio if no transmissions or key strokes are made within a specified time period. Prior to shutting down, the rig emits a number of beeps to warn the user of its intentions. "Power saver" mode puts the W2A into standby mode after five seconds of inactivity. The unit will then turn on every few seconds and check for a received signal. If the channel is quiet, the W2A goes back to sleep and the cycle repeats. If the channel is busy, the radio will remain on until activity ceases, then resume power saver mode. The "on/off" duty cycle is selectable between a 1:4 and a 1:16 ratio. "Power saver" works only when monitoring a channel—it does not function when using any of the scan modes.

Ironically, some of the W2A's biggest features are those which ICOM does not mention in the owners manual: extended wide-

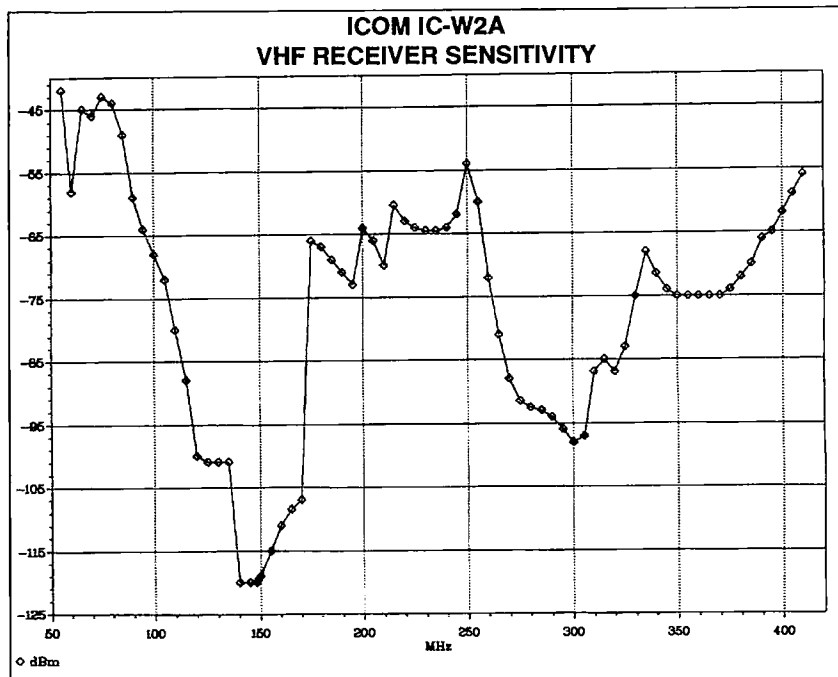


Figure 1. VHF receiver sensitivity (55-420 MHz).

band receive and crossband repeat. Both of these features are accessed through simple keyboard sequences without the need to open the radio or perform any hardware modifications.

Modifications and Operation

To open the coverage range of the receiver, turn the radio off. Then turn the radio on while simultaneously pushing the [LIGHT], [B], and [#] keys. After I performed this proce-

cedure, the receiver tuned from 55-410 MHz (including AM aircraft) on the VHF band. The UHF receiver covered 350-525 MHz and 725-1026 MHz (FM only)! *Warning: Please remember that it is illegal to monitor cellular phone conversations!* As expected, receiver sensitivity varied widely across these ranges. Due to high-pass filtering on the VHF band for image rejection purposes, don't expect to hear much below 118 MHz. Figures 1-3 show receiver sensitivity in dBm for a 20 dB quiet-

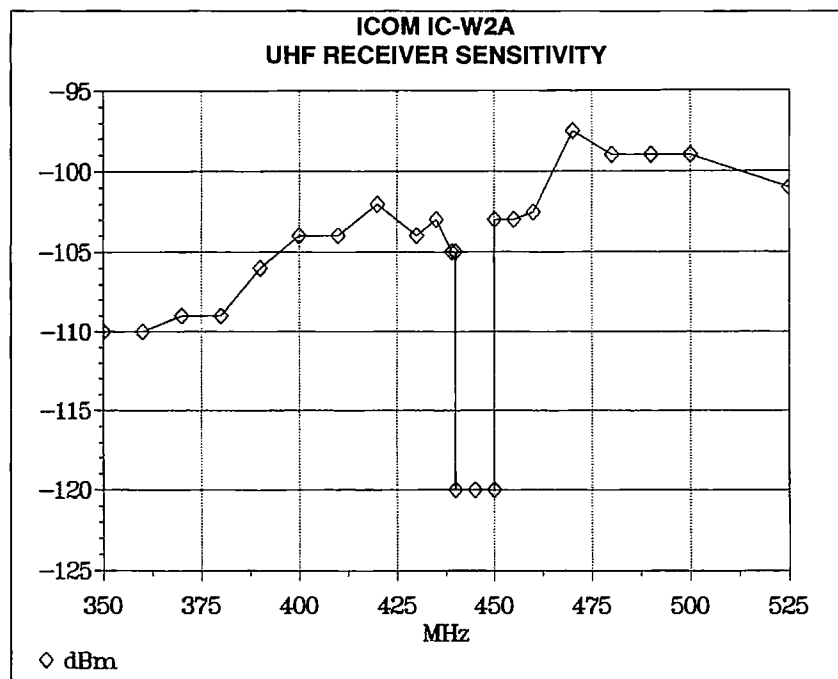


Figure 2. UHF receiver sensitivity (350-525 MHz).

ICOM IC-W2A UHF RECEIVER SENSITIVITY

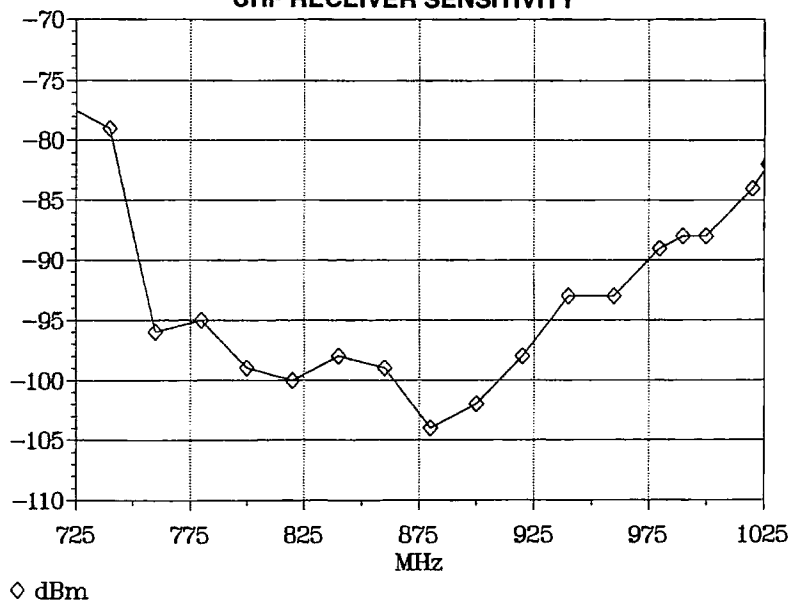


Figure 3. UHF receiver sensitivity (725-1025 MHz).

ing figure. For those not familiar with dBm, the sidebar table cross-references selected dBm levels to microvolts. Although the LCD display goes from 0-1300 MHz, these figures represent actual receive band limits as confirmed with a signal generator.

After completing this modification, access the radio's setup menu as per the instruction manual. Step through the options with the [UP] or [DN] keys and you will find a new parameter not listed in the ICOM manual, called PL. This sets the highest MHz place which can be programmed by the direct keyboard entry mode, selectable between 1 MHz, 10 MHz, and 100 MHz. Turn the tuning knob to set the PL parameter to 100, then press either the PTT or [CLR] to exit the setup menu. The VFO can now be tuned to any frequency within its extended receive range by simply entering the numbers from the keypad. For example, say the VFO is set at 440 MHz and you want to tune to 903.525. Simply enter: [#] [9] [0] [3] [5] [2] [5].

To enable the crossband repeater function, the above wideband receiver modification must be performed first. To activate the repeater, enter the desired frequencies and modes (simplex or duplex) and push the [VMAIN] key. While holding down the [FUNCTION] key, press the [2] key and then the [ENTER] key. The keylock [L] symbol will now flash on the LCD display, indicating that the unit is in repeat mode. To cancel repeat mode, push the [FUNCTION] and [ENTER] keys simultaneously.

Lab tests were performed using a Hewlett-Packard 8654A signal generator and 403B AC voltmeter, a DigiMax D-1200 frequency counter, a Measurements 920 peak deviation meter, a Daiwa wattmeter, a Heathkit Cante-

na dummy load and SM-5258 THD analyzer, a B&K 1630 DC power supply, and a Fluke 95 scope-meter. For frequencies above the H-P 8054's 535 MHz limit, the signal generator's second harmonic was used. This harmonic was measured and found to be 30 dB down from the fundamental. Then 30 dB was subtracted from the signal level settings. All graphs and/or charts show the corrected figures.

The ICOM IC-W2A utilizes dual-conversion receivers with a 30.85 MHz 1st IF (35.80 MHz on UHF) and 455 kHz 2nd IF. Receiver sensitivity measured 0.12 μ V for a 12 dB SINAD on both 2 meters and 70 centimeters. The 20 dB quieting level measured 0.22 μ V. Receiver sensitivity was essentially flat across both ham bands, and varied widely across the extended receive range, as shown in Figures 1-3. Image rejection measured 72 dB on 2 meters and 77 dB on 70 centimeters. Audio output measured 150 mW with 3% THD. Maximum audio output using ICOM's

dBm Versus Microvolts

dBm	μ V	Volts
0	220,000	0.22
10	70,000	0.07
20	22,000	0.022
30	7,000	0.007
40	2,200	0.0022
50	700	0.0007
60	220	0.00022
70	70	0.00007
80	22	0.000022
90	7	0.000007
100	2.2	0.0000022
110	0.7	0.0000007
120	0.22	0.00000022

10% THD reference was 220 mW.

On the transmit side of things, peak deviation measured 5 kHz for voice and 2.5 kHz for DTMF tones. Transmit frequency was 20 Hz low on 2 meters and 40 Hz low on 70 centimeters. Maximum RF power output measured 6 watts at 13.8 volts and 1.5 watts when using the supplied BP-84 battery pack.

Power consumption measurements were taken at 7.2 volts to simulate realistic current drain on the battery pack during typical portable operation. Where different readings were obtained depending on band, the first value is for the VHF unit and the second value (in parenthesis) is for the UHF unit. Unless otherwise noted, measurements were taken with only one band in operation. The receiver drew 50 (70) mA during no-signal squelched state, 150 (170) mA for full audio output, and averaged 13 (18) mA in power saver mode. With both receivers on, power consumption measured 117 mA during standby, 220 mA for full audio output, and 21 mA in power saver mode. Activating the backlight added 15 mA to the battery load. Transmit current measured 410 (625) mA at the lowest power setting and 780 (970) mA at the highest power level. At 13.8 volts, transmit current measured 1.5 (1.7) amps at maximum RF output.

Real-world use tests were conducted over a six-week period during which the W2A was used in base, portable, and mobile environments. Audio output was ample for base and portable operations, but a little light for mobile use in a noisy vehicle. The LCD display was easy to read from a wide range of angles. The dual LED backlight provided sufficient light to read the display at night. Very few intermod products and virtually no birdies were noted on either band, even when operating in areas of high RF clutter around Springfield, Massachusetts. Those that did occur were usually well outside both ham bands in the W2A's extended receive range. The operator's manual was relatively clear and easy to understand, with only a few confusing sections.

Although it was easy to inadvertently hit a key on the crowded keyboard and QSY to another frequency or send the rig into scan mode, the keylock feature proved extremely useful for preventing such accidents during mobile operation by locking out all keys except PTT, power, light, and hi/low RF power. The PTT lockout feature proved handy when leaving the rig in the presence of co-workers and other non-hams, and could be a real plus for hams with children. The W2A's small size and light weight also made for comfortable, extended-duration QSOs while commuting to work. Although the metal rear cover became fairly warm during long-winded QSOs, it never became uncomfortable to the touch. The W2A's mechanical construction also appeared quite durable; it survived a few accidental drops of two to four feet (definitely not recommended!).

The W2A's lack of sufficient low-battery warning was annoying. The radio would operate flawlessly right until the battery went

Continued on page 42

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Franklin IN 46131

Async Comms, Part 2 (Finally)

Whoops! The flurry of paper, bits, and phone calls here at N1EWO Central Control sucked up this second half (continued from the March 1993 "Packet & Computers" column) of our async primer and spit out the first half of a different series. For those of you who got confused, it wasn't your fault—it was mine. So, the result is that we will have interleaved multipart columns for this and next month.

When we last left our data, it was timing itself—allowing us to communicate asynchronously. Let's review a little. The term asynchronous (async) means "without the same time." It comes from the Latin roots "a," for without; "syn," for the same; and "chronos" for time. As you can see, it's a strange sort of word. It sets up a complicated idea and then adds "not." What this whole mess means to digital communications is that the data on an async link does not depend on a common "clock"—regulating signal—to figure out each bit as it goes by.

Before I completely confuse you, let's take a step back. Why is time important at all? OK, binary communications (that use only two states—on and off, high or low, etc.) depend upon time to create combinations that can be interpreted as characters. The "canvas" upon which the character is "painted" is time. In contrast, printed communications use space as their medium. As you look at written communications, you are concerned with how the marks or the paper (or display) relate to the space they occupy. The terminal's space is time. It concerns itself with the relationships that the bits form in time to figure out their content. This makes time the medium upon which the data is written. Don't worry if you don't get this, it is not critical to understanding this stuff. If you do get it, though, it will help you understand.

So, we are dealing with something that happens over time. The receiving station has to know when a bit (the smallest unit of data—a binary 1 or 0) has gone by. You'll get a better feel for this if you think of a data stream that has, say, seven 1's in a row. Without some sort of timing, the receiving station would have no way of telling that this was not just one big 1, since the signal will not change for the duration of the seven 1 bits. The obvious solution is to have one side be in charge of the timing. This is called synchronous communications. In this scheme we send a standard clock signal along with the data, and the data stream is

interpreted by this timing. In our seven 1's example, seven ticks of the clock would count off the seven bits as they went by. This works fine, but while it is conceptually simpler, it is more complicated to implement on a real data channel.

The alternative scheme is our subject—asynchronous communications. The name, async, is a bit confusing. While it implies that time is not important, this is not true. What it really means is that there is no master clock. The data is self-timing. Each async character has what are called "framing" bits. These are the start and stop bits that you are probably familiar with from setting in your communications software, or even from using dip switches inside a dumb terminal. These framing bits let the receiving station know that the character has started and stopped. This makes each async character its own clock. Well, at least to a point. You still need to know at what speed the data is being sent. It isn't a free-for-all. The framing bits let the receiver sync(hronize) to the bit sequence. There are standard data rates that must match.

Back to Earth

So, what's the practical upshot of this academic stuff? For those with a nuts-and-bolts bent, it means that for the TNC and computer to successfully communicate they must be set to the same data parameters. The most common setting, and the first to try if you don't know what is the right combination, is 7E1. 7E1 is shorthand for 7 data bits, Even Parity, 1 Stop bit. Let's break that down.

7 Data Bits

This means that the characters are made up of 7 bits. This is fine for the standard ASCII (American Standard Code for Information Interchange) character set. Seven bits allows for 128 different combinations—in this case characters. This is fine for most communications, but for graphics characters (which are in the extended ASCII set) or binary file transfer, which uses all 255 combinations that the 8 bits of a byte allow. (Note: Binary file transfer using 7 bits is possible, but it requires special software to encode and decode the information on each end.) Seven bits is the de facto standard because it is usually all that is needed, but 8 bits is a possible value as well.

Even Parity

The parity bit is used for error detection. You are unlikely to actually find software that does anything with it other than report an error. In other words, it is not used for error correction. In any case, it works like this:

The bits in the data are added together and the parity bit is set to a value that will make the result either even or odd, depending upon the setting. For example, in the case of an "e" the data bits, "1100101," add up to four. This means that for even parity the parity bit gets set to zero. This is because four is an even number. If the parity were set to odd, the parity bit in this case would be one—which added to four makes the odd five. Your main concern with parity is to set it the same on both ends.

1 Stop Bit

The stop bit is the complement of the start bit. Every async character has a start bit and at least one stop bit. You can set stop bits to 2, though. Again, your main concern is to match the two ends.

The Speed of Things

As I mentioned before, the rate of the data transmission must also match on both ends. Data rate is measured in bps (bits per second). It is also measured in bauds (named for J.M.E. Baudot, a French engineer from the 1800s). These two can be—but are not necessarily—the same. A baud is a state change or transition—say from on to off. A baud can transmit one or more bits. In the simplest case, bps = bauds because one bit is sent for each transition. This will be the case for the connection between your terminal and TNC. As soon as we start to discuss modems with data rates higher than 1200 bps, the picture changes.

Because modems work by changing data to audio and back again, the bandwidth (frequency range) with which they have to work puts a limit on how many bauds (transitions per second) they can transmit. Most modems are designed to work on voice channels which offer a bandwidth of about 3000 Hz. So to get around the relatively narrow bandwidth, high-speed modems use a technique that combines the frequency information of the signal (FSK—Frequency Shift Keying), and the phase information (PSK—phase shift keying). This scheme is called trellis encoding. It uses combinations of frequency and phase in a table that resembles a trellis, hence the name. This approach allows more than one bit of information to be encoded into each transition—or greater than one bit/ baud.

Practically speaking, you need to make sure that each end of the data link is set to the same speed. What should this be? My general purpose recommendation is 9600 baud. A good question is, "If the on-the-air data is only going 1200, why set the comm link at 9600?" Well, if the only data that was sent over the link was from the on-the-air link, that might make sense. But the TNC sends status messages, mail, and other traffic to the terminal. It is much more pleasant to work with the TNC at the higher data rate. On the other hand, it is not a requirement. While you might experience difficulties—like buffer overflow—

if you set the link below 1200 baud, it is not necessary to set it higher than 1200—it will work fine there.

The next part of this series will appear in two months. I will cover the software side of this confusing but vital part of packet radio.

The Survey Continues!

A few months ago I started publishing a set of survey questions which I thought I would run for a couple of months and then publish the results. Well, the response has been increasing rather than decreasing so I thought I would put them in here once again and give you another chance to respond. It's not too late, but this will be the last time I ask for responses. You can use E-mail or paper mail to answer the survey.

1. What is your callsign?
2. What is your license class?
3. What computer(s) do you use in the shack?
4. What operating system/environment version(s) do you use?
5. Which digital modes are you equipped for?
6. Which digital modes are you active in?
7. Which of these columns (month, year) has been your favorite (if any)?
8. What has been your biggest problem with computers in ham radio?
9. What would you like to see in this column?

10. Any comments:
You don't need to copy the questions, just put the number before your answer. Answer all the questions, or just the ones you want. Make the responses wordy or brief. I really want your feedback to make this column something you look forward to each month. Thanks so much for your participation.

Electronic Addresses
Packet: N1EWO@NICENI/OARY
(Note: I'd love to hear from you on packet—but not about the survey! This survey is the business of this magazine, and we can't do that on ham radio. A personal note or test message is just fine.)

Internet: jsloman@mcimail.com
(This is my preferred address.)
MCI Mail: jsloman
(This is the same as above, but direct.)

CompuServe: 71221,1143
(This is my least favorite place to get mail, but it is OK.)

Even if you don't answer any survey questions, I am very interested in anything you have to say. I can't answer every message—though E-mail has a much better chance. Many of you have written asking for help. You have not been forgotten; I am planning a "mail bag" column for the near future where I can answer the many similar questions that come in. For those of you who have written saying that you enjoy the column, thanks. For those of you who would like to see additions/changes, please write to me—it's the only way I have of knowing what you need and want. 'Til next month, 73 de N1EWO.

ICOM IC-W2A

Continued from page 39

dead, giving virtually no warning whatsoever. When the battery finally did run down, the only warning was a howling or oscillation in receive mode or a transmitter which cycled on and off if the PTT key was pressed. Once either of these events occurred, there wasn't enough juice left in the battery to even sign off. On two occasions I was unable to shut off the radio with the power button (which ties into the CPU and is not a hard-wired power switch). The only way to get the unit to stop howling or keying was to remove the battery pack. It would have been nice had ICOM used the front panel status LED to warn of an imminent dead battery condition a minute or so before the rig actually goes dead, as was done in the IC-2/3/4AT series of handhelds.

My biggest disappointment with the ICOM IC-W2A was its limited transmit frequency coverage on the 70 cm band. The W2A transmits between 440 and 450 MHz only. With its full crossband duplex modes, this HT would have made an excellent basis for a portable OSCAR AO-21 platform, had not the 435 MHz FM uplink frequency been locked out of the transmit range. A call to ICOM's tech line confirmed that there was a mod available to open the transmit range, but ICOM would not reveal the mod, stating that it was a "dealer mod." A call to two dealers proved fruitless, while a third dealer offered to perform the modification for a fee, but only if a MARS or CAP license was presented. ICOM would do well to provide a simple mod or upgrade the programming to enable transmit in the 430 to 440 MHz range. With an HT this advanced, they have truly limited its potential and missed a golden opportunity to introduce users to satellite communications.

Other drawbacks were minor, but equally irritating. These included an oddball DC power connector, the likes of which I have never seen anywhere other than on the pages of an ICOM accessory catalog. Although the battery packs are interchangeable between the W2A and the 24AT, forget the speaker mike or headset units. If you've ever charged an ICOM BP-4 in a BC-30 charger, you'll be as surprised as I was to discover that the W2A's

BP-90 battery cases cannot be recharged in a drop-in charger. Finally, the shape of the belt clip made it virtually impossible to hook the radio on a back pocket with one hand. Attempting to do so was an exercise in aggravation. The shape of the clip caused it to prefer plowing through material rather than sliding over it. The only way to engage the clip was to use one hand to pull on the pocket and place the material under tension, and use the other hand to force the clip down over the pocket lip.

A Bargain

All things taken into consideration, the best way to sum up the ICOM W2A is to call it a bargain. Although \$500 is not cheap for an HT, one must remember that the W2A is basically two completely independent single-band radios sharing a single case, and is capable of doing anything two separate HTs could do, except transmit on both bands simultaneously. The BP-84 heavy-duty battery and the included PL encode/decode board make the radio quite an attractive value. Toss in the wideband receive modification, and it's like getting a portable scanner for free!

The ICOM W2A is not for everybody. With so many features packed into such a small package, plan on spending at least four or five hours with the owner's manual learning what all those double and triple function buttons do. It took me about a week to learn my way around all the features and extras packed into this little HT. For those willing to take the time to read and understand the manual, the W2A is an exceptional rig.

Rating this HT on a scale of one to 10 was difficult. Receiver sensitivity, frequency coverage, features, ease of use, layout, appearance, and performance all deserved a solid 10. However, I could not overlook the unit's inability to transmit on legitimate 430 MHz satellite FM uplink frequencies, nor the difficulty experienced in trying to get it to do so. The incompatibility of some accessories between the W2 and 24AT, along with the weird power connector and lack of any advanced low-battery warning also pulled down the overall rating. On a scale of 1 to 10, I would rate the ICOM IC-W2A at 8-1/2.

An Everything Amplifier

Continued from page 28

Results

At 223 MHz the amplifier will put out more power than is legal for Novice operators. However, this power can be backed up to the legal 25 watts by adjusting R3. I tested this amplifier with my 1.25 meter handie-talkie, 2 meter handie-talkie, 6 meter transceiver, 10 meter mobile rig, a 10 MHz home-brew transmitter, and an HF rig at 3.5, 7, 10, 14, 17, 21, 24, and 28 MHz. The amp does not work well at 3.5 MHz, but it does at the other frequencies tested. At HF frequencies with only 13 volts from the power supply, 1 watt input gives a little more than 30 watts out. One point cannot be emphasized enough: Do not put more than 25 watts into this amplifier—so be careful if you test this amplifier with a transmitter that is capable of putting out more power than that.

If the amp is used for SSB, the relay may not want to stay engaged. It may be necessary to manually key the relay if you're going to use the amp on SSB or to design a circuit that will delay the relay from opening once it closes.

As the power supply voltage is changed, the bias will sometimes have to be adjusted. Furthermore, bias sometimes has to be changed if you go from one band to one of a much different frequency. The power gain of a broadband amplifier will go up at the lower frequencies, and if you switch to a lower frequency with no adjustment, the amp may go into oscillation.

Receive sensitivity is slightly reduced—especially at the higher frequencies. If you want to get the receive sensitivity back up to the level it would be without the amplifier, consider installing a broadband preamp.

Remember that FCC regulations, common courtesy, and good operating practice require the use of minimum power when operating on the airwaves. Also remember that experimentation is one of the main reasons for our hobby.

My thanks to the XYL, Carolyn KC4NBE, who encouraged me in the project and proofread the manuscript. Also thanks to Will Payne N4YWK, who worked with me on the project and gave me tips that enabled the amplifier to work.

Bibliography: Motorola Semiconductor Products, Inc., *RF Device Data*, Vols. 1 and 2, 1990.

Approximate Metric to English Conversions

	List: 65mm 2-19/32"
50mm	1-63/64"
40mm	1-19/32"
35mm	1-25/64"
11mm	7/32"
6mm	15/64"
5mm	13/64"
1mm	Less than 3/64" or more than 1/32"

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PD-144-3	144-148 Mhz. Preamp. Incl.	Linear	4-5 watts = 35W	T/R	139.
PD-144N-2FM	144-148 Mhz. Preamp. Yes	FM	4-5 watts = 60W	T/R	175.
PD-220N	222 Mhz.	No	4-5 watts = 35W	T/R	119.
PD-440N	420-450 Mhz.	No	1/2 or 4-5W = 18W	T/R	119.
PD-440N	420-450 Mhz.	Yes	1/2 or 4-5W = 18W	T/R	143.
PD-440N-1		No	1/2 or 4-5W = 35W	T/R	155.
PD-440N-1		Yes	1/2 or 4-5W = 35W	T/R	179.
PD-440N-2		No	1/2 or 4-5W = 60W	T/R	285.
PD-440N-2R		No	3-4W = 60W	T/R	199.
PD-440N-3		No	3-4W = 60W	T/R	235.
PD-440NM		No	1/2 W = 6W	T/R	75.
PD-440NM		No	1/2 W = 6W	T/R	118.
PD-900N	902-928 Mhz.	No	1/2 W = 10W	T/R	65.
PD-900N	902-928 Mhz.	Yes	1/2 W = 10W	T/R	90.
PD-331HP	902-928 Mhz.	No	1 W = 18W	T/R	265.
PD-331HP	902-928 Mhz.	No	1 W = 16W	T/R	299.
PD-331P		No	1 W = 6.5W	T/R	119.
PD-331P		No	6 W = 15W	T/R	125.
PD-331VP-1		No	5mw = 8W	T/R	123.
PD-331VP		No	1/2 W = 1.5W	T/R	59.
PD-33 Doublor	70 cm. = 33 cm.	No	1/2 W = 1/2 W	T/R	65.
PD-33 Doublor	70 cm. = 33 cm.	No	1/2 W = 1.0W	T/R	85.
PD-1200N	1.2 Ghz. Preamp	No	1 W = 18W	T/R	149.
PD-1200N-2	1.2 Ghz.	No	1 W = 16W	T/R	205.
PD-1200N-3	1.2 Ghz.	Yes	1 W = 16W	T/R	299.
PD-1200N-1	1.2 Ghz.	No	3 W = 36W	T/R	285.

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Electronic Project Panel Labels

Let your computer help.

by Marion D. Kitchens K4GOK

After finishing the electronics on your latest project, the next matter at hand is a suitable enclosure, followed immediately by the problem of labeling. How do you make your electronic marvel look like a professional piece of work? There are a number of different ways to accomplish that task, all with various degrees of difficulty and varying qualities of results. Many hams resolve this problem with rub-on lettering, stick-on tape labels, etc.

With the advent of desktop publishing on personal computers, there is another way that is quick and easy, and produces top quality results. The desktop publishing technique has several advantages over other methods. It allows you to design the panel

electronically, so changes are easy to make without the hassle of physically changing things. This way you can get the layout exactly the way you want it, before "cutting metal." The only limit to the degree of detail and complexity is your imagination: You can put whatever you want on the panel, including graphic images. If you can do it on the computer, you can put it on a panel.

As a practical matter, a printed copy of the panel layout can be used as a template for drilling holes and making cutouts on the physical panel. This assures proper alignment and location of switches, jacks, indicator lights, etc.

This article describes the desktop publishing method and the resolution of the pitfalls

the author encountered. Hams who build electronics projects are encouraged to "dress them up" with professional-looking panels and labeling.

Making a Panel

I recommend making an initial rough pencil layout of the panel. Make sure that you plan for all the switches, control functions and the like that the project either does have, or may have in the future. Leave room for additions or embellishments to your project. See Photo D for an example of a rear panel showing jacks for just such future embellishments.

Use your favorite desktop publishing software to make a full-size layout of the panel.

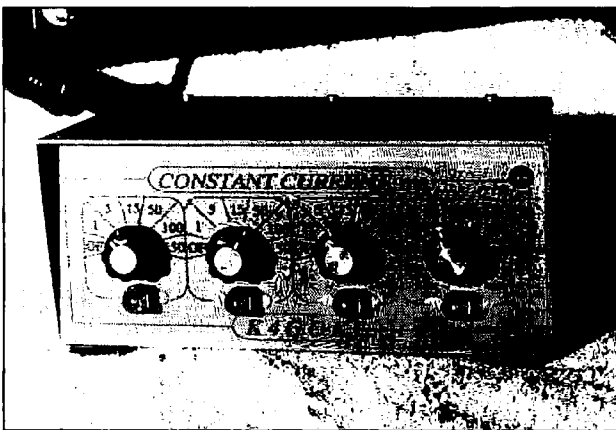


Photo A. The "CONSTANT CURRENT," panel made with a 9-pin dot matrix printer.



Photo C. The "roll on" technique recommended for application of the film.

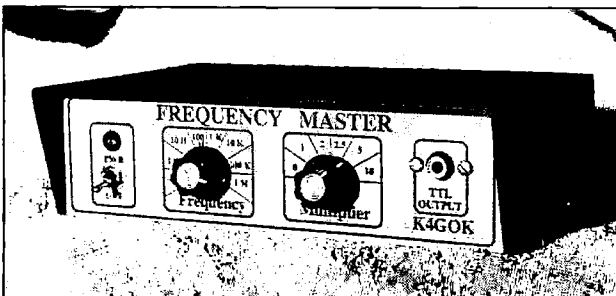


Photo B. Front panel of "FREQUENCY MASTER," showing the computer-generated panel layout.

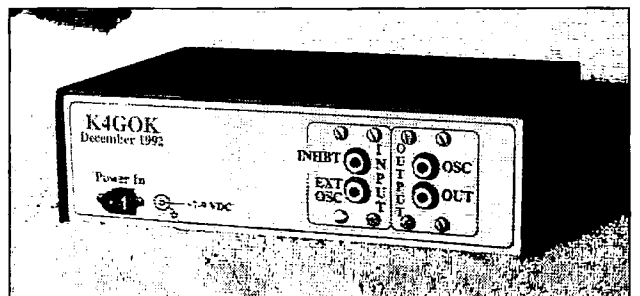


Photo D. The rear panel, showing provisions for "embellishments" as mentioned in the text.

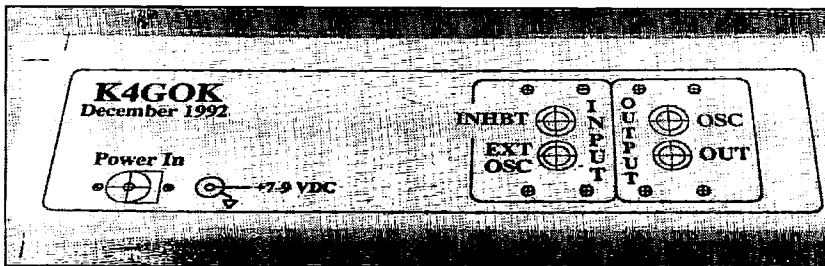


Photo E. A painted panel with the film in place, ready for cutting to shape and drilling.

Make sure you have it the way you want it: The finished product will be exactly like that in the computer. Print out a copy of the finished layout to be sure it is OK. For best results, I recommend a laser printer, but 9-pin dot matrix printers can also produce quite good products. The "CONSTANT CURRENT" panel shown in Photo A was done with a 9-pin dot matrix printer.

Take your final artwork to your local copy shop. Make a copy on paper, and a copy on transparent stick-on film. The film used for making the "FREQUENCY MASTER" panel shown in Photo B was called Graphic Applique Film. It was the brand offered by my local copy shop, and should be available widely. It works well, without stretching or distortion during application.

I recommend completing all the metal work and painting before applying the film.

This results in the best-looking panel, but it also requires careful alignment of the film before sticking it in place. The film sticks tightly and can pull the paint off if it is lifted for realignment. Use the paper copy for drilling and cutting the panel. Rubber cement works great for sticking the paper copy to the metal panel. I found out the hard way that "100%" size on most copy machines is not actually 100%. But if you use the paper copy, it will be the same size as the film you will be applying later. When cutting the panel from the material you use (I used double-clad PCB here), leave a small tab on one end. I left about 3/4" on the end of the "FREQUENCY MASTER" panel (Photo B). This tab serves as a place to stick the film down while aligning it with the panel. Cut off the tab after applying the film.

Alternatively, the film can be applied be-

fore drilling and cutting the panel. If you use this technique, sharp drills and cutting tools must be used to prevent damaging the film during that operation.

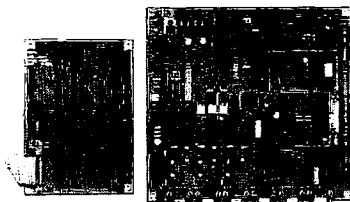
Apply the film by aligning it carefully and sticking it down to the tab. Bend the film so that the stiff backing will "unroll," and rub the film down with your finger as it comes in contact with the painted panel. See Photo C. Apply only a small area at a time. Make sure all the small air bubbles are rubbed out as you go. Any trapped air will not come out later. It is important that the air be rubbed out as the film is applied.

The edges of the film can either be rolled around the edges of the panel and stuck to the backside, or trimmed neatly to the panel edges with a sharp X-acto knife. I recommend putting a thin bead of white glue around the trimmed edges to prevent clumsy handling from lifting the film during use.

The film needs no protection for normal handling—the lettering seems to be durable. Once the film is applied to the painted panel it is ready for use.

Using the desktop publishing technique produces craftsman-quality labeling for home-brew electronic projects. The results are comparable with rub-on lettering and India ink, and can be achieved with considerably less time and effort. I recommend this technique for all who enjoy building electronic projects.

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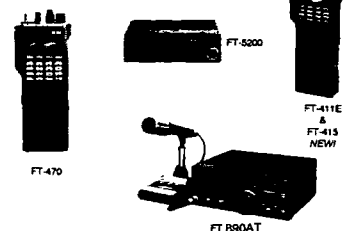
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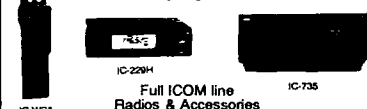
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Home-Brewing Your Own RF Filters

Radio frequency filters are inductor-capacitor networks that pass one band of frequencies, while rejecting all other frequencies. Hams use RF filters in a wide variety of applications: keeping harmonics at the transmitter, preventing out-of-band signals from getting into the receiver, etc. There are four basic types: low-pass filters (LPF), high-pass filters (HPF), band-pass filters (BPF) and rejection filters (called notch filters when the rejection band is narrow, and bandstop filters when the rejection band is wider).

The LPF and HPF frequency responses are shown in Figures 1A and 1B, respectively. In the LPF (Figure 1A), all signals from DC to some cut-off frequency (F_c) are passed, but above F_c the response falls off to the

point where there is little signal passing. The cut-off frequency is usually defined as the point where the frequency response falls off -3 dB from the in-band response. The HPF characteristic is shown in Figure 1B, and is exactly the opposite of the LPF: It rejects all frequencies below its cut-off frequency, while passing all frequen-

Table 1.						
No. Elements	Ripple (dB)	C1	C2	L1	L2	L3
5	1	3473.1	3473.1	16.99	23.88	16.99
5	0.1	4364.7	4364.7	9.126	15.72	9.126
5	0.01	4153.7	4153.7	6.019	12.55	6.019

deed. But if you use tables of values for "normalized" generic filters, then the job becomes a lot easier . . . and certainly falls into the "easily do-able" category. I recently tried my hand at a number of RF filters for different purposes, only some of which are related

HPF and LPF designs with overlapping cut-off frequencies of 3,000 kHz or so (the exact frequency was not critical). Second, I needed an 8,000 kHz LPF for a small 40 meter 1.5-watt power oscillator that I was building. Finally, I needed an LPF that would reject the AM broadcast band, while passing LF/VLF signals. For these projects I turned to the *ARRL Handbook* for the normalized tables. The circuits are found on page 2-51 in the 1993 edition, while the tables are found on pages 2-51 and 2-52. Figure 2 shows the basic LPF circuit, while Figure 3 shows the HPF case (both use the part designations found in the *ARRL Handbook*).

The tables give the values for the normalized case where $F_c = 1$ MHz; the inductances are given in microhenrys (μ H) and the capacitances in picofarads (pF).

Example: The Low-Pass Case

In this example let's look at my 3,000 kHz LPF. It was used in a sweep signal generator that I designed for the AM broadcast band, and for common AM IF frequencies (e.g. 455 kHz). I needed it to facilitate a project that I am working on: a super AM DXer's receiver (sorry, no details as yet). A portion of the normalized 1 MHz data from Table 20, p. 2-52, is shown in Table 1.

The number of elements in the complete table varied from three to nine (odd numbers), but because this filter has two capacitors and three inductors, only the five-element data is reproduced (see the book for the complete table, as well as those for the HPF and other designs). The ripple data refers to the maximum ripple in the passband of the filter, and is expressed in decibels (dB). I selected the 0.1 dB figures.

The table data are normalized to 1 MHz, so to find the values of inductance and capacitance needed for the actual filter divide the values in the data table by the frequency in megahertz (MHz). To find the values for my 3,000 kHz (i.e. 3 MHz), 0.1 dB ripple LPF I divided the *ARRL Handbook* values by three:

$C1 = C2 = 4364.7/3 = 1454.9$ pF; $L1 = L3 = 9.126/3 = 3.04$ μ H; $L2 = 5.24$ μ H.
C1: 1454.9 pF
C2: 1454.9 pF
L1: 3.04 μ H
L2: 5.24 μ H
L3: 3.04 μ H

The coils are relatively easy to come by: Wind them on Amidon Associates [2216 East Gladwick Street, Dominguez Hills CA 90220; phones: (voice) 213-763-5770, (Fax) 213-763-2250] coil forms. The T-50-2 (RED) cores have an AL value of 49, and op-

"The filter projects turned out so well that I am convinced it is another case of . . . the contriving of contrivances is a game for all."

cies above F_c . Note that these curves are a bit idealized; real RF filters are not so smooth either in the passband or outside it.

If you start "raw" and design your own filter, then the task is daunting in-

to ham radio, but all of which illustrate the principles involved. You can also use the same method to design filters for your own purposes.

I had several projects in mind when I built some filters. First, I needed both

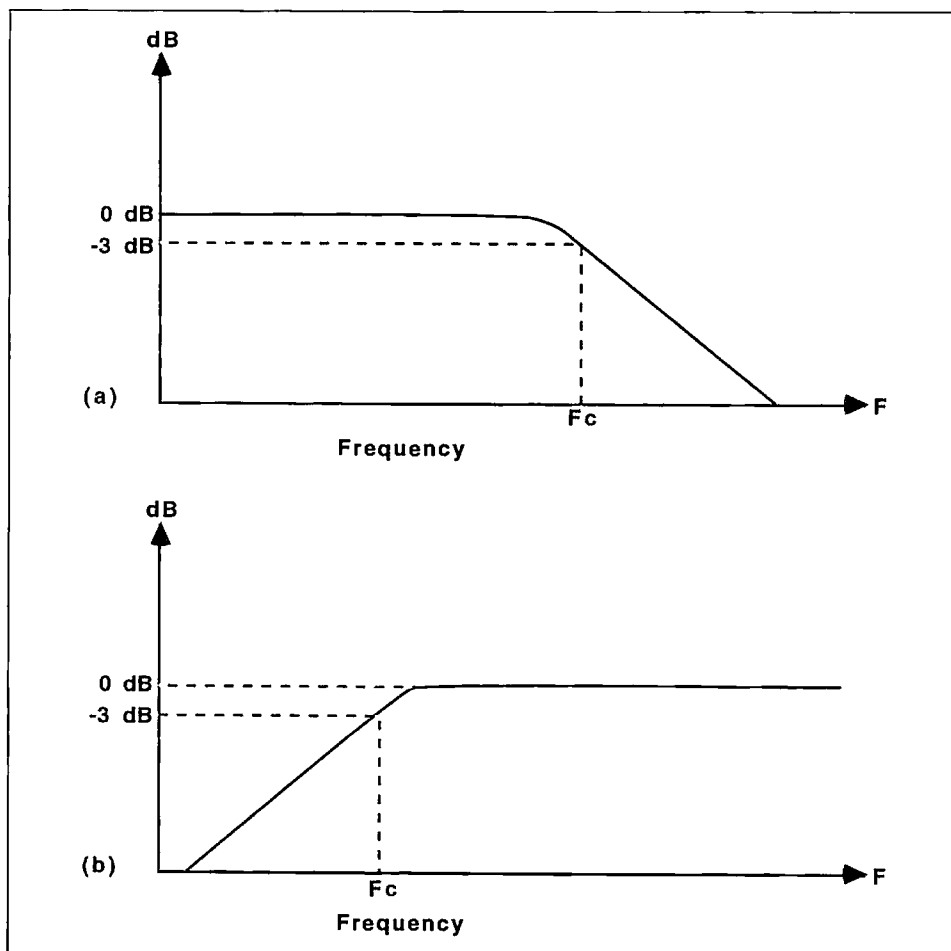


Figure 1. A) LPF frequency response; B) HPF frequency response.

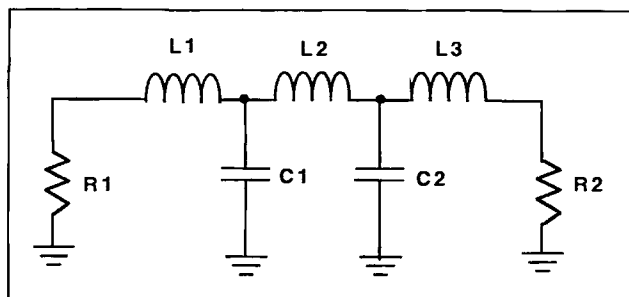


Figure 2. LPF circuit.

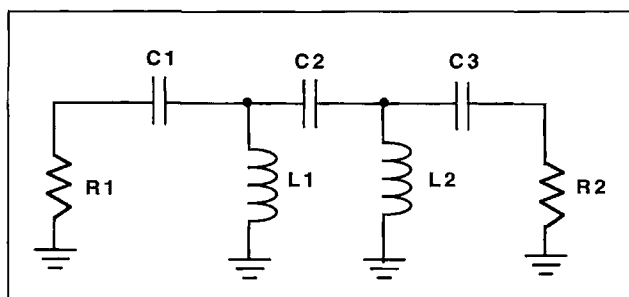


Figure 3. HPF circuit.

erate from 2 to 30 MHz, while the T-50-15 (RED/WHT) have an AL of 135 and operate over 0.1 to 2 MHz. In practice, I found that 3 MHz was not unreasonable for the -15 cores, so I opted to use them. Applying the formula below gave the number of turns:

$$N = \sqrt{L_{\mu H} / A_L}$$

L1, L3: 3.04 μ H, 15 turns, T-50-15 (RED/WHT)
L2: 5.24 μ H, 20 turns, T-50-15 (RED/WHT)

The capacitors are another matter. Where in blazes do you get a 1454.9 pF capacitor? Well, one solution is to use a 0.0015 μ F (1,500 pF) and live with the slight frequency error. I did this and found that the filter had a cut-off frequency only slightly lower than

3,000 kHz, and it was acceptable. Otherwise, it is possible to select standard value capacitors that in some series or parallel combination total 1454.9 pF, or something close to it. For example, 75 pF, 560 pF, and 820 pF add up to 1455 pF, and all are easily available values.

The capacitors used in the filter should be NPO disk ceramic, silvered mica, or polyethylene. I bought several dozen of all types recently from Ocean State Electronics [P.O. Box 1458, 6 Industrial Drive, Westerly RI 02891; phones: 1-800-866-6626 (orders), 401-596-3080 (inside RI), or 401-596-3590 (Fax)]. Ask them for their catalog . . . you'll find a lot of ham building parts that you thought were "history" because other parts distributors no

longer carry them.

Another approach is to use a combination of fixed-value and trimmer capacitors in the filter. This is a viable approach if you have a sweep generator and oscilloscope to align the filter, but can be a "bear" if you don't. A procedure for alignment of such filters is given in Hayward and DeMaw's *Solid-State Design for the Radio Amateur* (an ARRL publication).

The filter projects turn out so well that I am convinced it is another case of " . . . the contriving of contrivances is a game for all."

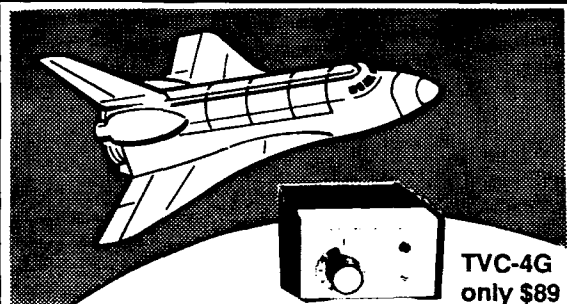
Book Note

One of my publishers has moved, and has also added an "800" number

for credit card orders. HighText Publications is owned by Harry Helms and Carol Lewis. Their address is: 125 North Acacia Avenue, Suite 110, Solana Beach CA 92075; phones 619-793-4141 and 4142. Credit card orders are handled by IPG at 1-800-888-4741. They publish my *Receiving Antenna Handbook* and *The Art of Science*, as well as Harry Helms' books *All About Ham Radio* and *Shortwave Listening Guidebook*.

They now claim to be the biggest technical publisher west of Pacific Coast Highway (or, is that the only publisher west of . . . ?), and to have sales greater than the combined profits of IBM and General Motors. Helms, you're dangerous.

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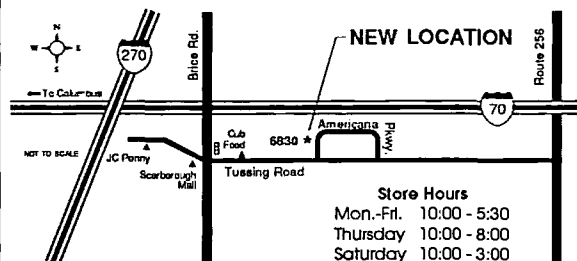
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SSTV From Space

Only 10 days after the launch of AMSAT-OSCAR-6 in October 1972, Don Miller W9NTP wrote a letter to the editor of the *AMSAT Newsletter* describing his efforts with WA9UHV to send slow-scan television images via the new satellite.

In his letter Don described systems that included equipment that might be found in a ham radio museum today, but 20 years ago represented state-of-the-art gear. HF transmitters with transverters and home-brew video samplers and modulators provided uplink signals, while more home-brew equipment was used to view the black-and-white images sent through the Mode "A" (2 meters up and 10 meters down) transponder. These pioneering efforts have provided inspiration for today's video experiments and some exceptional possibilities for later this decade.

In his mid-seventies book, *OSCAR Amateur Radio Satellites*, Stratis Caramanolis recounted efforts by DL8AT and OE3KMA to send SSTV pictures via the Mode "B" (70 cm up and 2 meters down) transponder on AMSAT-OSCAR-7. The year was 1976 and eight-second, black-and-white pictures were still the standard. These efforts led to additional image transfer techniques including facsimile (FAX) transmissions by DL0VB and others.

During the 1980s emphasis was placed on the purely digital modes like AX.25 packet. Today we have

several digital-only satellites in orbit, capable of providing worldwide store-and-forward services. Sending image files via these electronic bulletin boards in the sky has become common. Real-time image exchange via satellite declined, but thanks to advances in inexpensive digital interface techniques and individual efforts, SSTV operation is again gaining popularity.

SAREX and SSTV

Dr. Tony England W0ORE took the Shuttle Amateur Radio Experiment (SAREX) equipment to orbit on the shuttle *Challenger* in August 1985. Part of the ham gear included a modified ROBOT 1200C scan converter for SSTV. The image-control software on the shuttle supplied automatic sequencing, providing two red-filtered frames (8 sec.), one green and one blue; a low-resolution color frame (12 sec.); and a high-resolution color image (36 sec.). Many stations monitored the signals using home-brew SSTV systems or new and expensive ROBOT equipment. Others simply recorded the warbling tones in hopes of someday decoding the cryptic sounds and viewing the pictures.

Further experiments with SSTV from the shuttle continued on missions STS-37 and STS-50. The equipment will be carried on STS-56 and other future flights.

In addition to sending pictures earthward, the shuttle apparatus can also receive and display images sent from earth-bound hams. During Tony England's flight, a picture of the astronauts' wives was sent up to space and displayed on one of the monitors



Photo A. A 36-second ROBOT color image of Tony England W0ORE on the Space Shuttle Challenger—August 1985.

located in the Aft Crew Station. The picture was stored and sent back to earth a few minutes later. During STS-50, schools with suitable SSTV gear sent pictures of the students up to Dick Richards KB5SIW and the other ham crew members on board the *Columbia*.

There are advantages and disadvantages to shuttle-based SSTV operation. On the plus side, the signals are sent via 2 meter FM transceivers. Signals are strong and color errors caused by frequency shift experienced using SSB are not a problem. The greatest disadvantage is the length of time available for picture exchange. Shuttle passes are usually very short, 10-15 minutes. The ROBOT equipment is capable of a 72-second mode, but images are usually sent in the 36-second mode to allow the exchange of as many pictures as possible. The ROBOT gear is also limited to those ROBOT

modes hard-coded in the scan converter.

SSTV and the PC

PC-SSTV interfaces have lagged behind those for other machines like the Amiga, and only a few dedicated hams have been able to buy a ROBOT 1200C at over \$1,000 for computer-less operation. Although the Amiga computer and appropriate interface cost less than a ROBOT, those already heavily invested in PC-compatible machines (most of us) don't consider either a viable alternative.

Early attempts to provide SSTV support on PCs required the use of the cassette port to input the tones. Rough, blocky, black-and-white pictures could be seen from the eight-second format frames on monochrome monitors. The software was crude and the results poor. Better interfaces, faster machines



Photo B. A 36-second ROBOT color image of Ken Bowersox, Carl Meade and Dick Richards KB5SIW on board the Space Shuttle Columbia (STS-50)—June 1992.

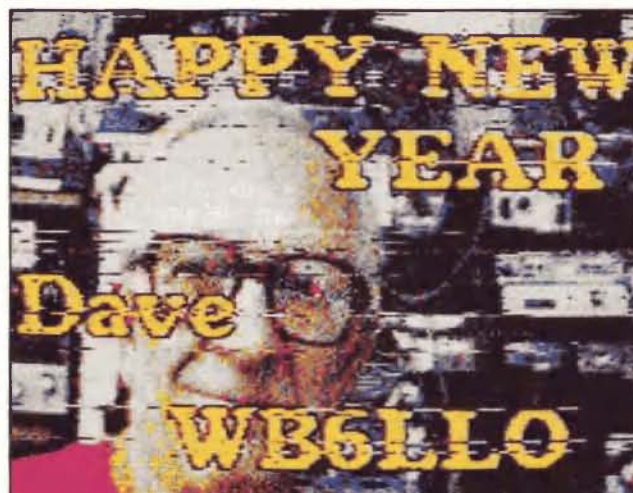


Photo C. Dave WB6LLO poses for a 72-second ROBOT color picture sent via AMSAT-OSCAR-13.

and improved video were needed. Recent offerings have certainly helped.

For the satellite enthusiast looking to get results without a significant investment, there are two inexpensive PC-SSTV interfaces available.

The first is the Viewport VGA from A & A Engineering. This unit was described in a construction article by J. R. Montalbano KA2PYJ in the August 1992 issue of 73. A complete kit from A & A Engineering (telephone: 714-952-2114) sells for \$169. This unit transmits all the ROBOT modes through 72-second color and receives ROBOT plus Scottie and Martin formats. Recent modifications also allow operation with a new FAX mode defined by Ralph Taggart WB8DOT in the February 1993 issue of QST. The Viewport VGA is an external interface box that connects to the PC through the printer port.

The second recent offering for PC owners looking for a way to do SSTV is the Pasokon-TV interface card and software. The card uses a slot in the PC (286 or better) and provides full transceive operation with all of the popular SSTV modes, including ROBOT, Scottie, Martin and others. The kit costs \$200 and is available from John Langner WB2OSZ at (508) 256-6907.

Hamsat SSTV

Most SSTV operation via satellite is currently on AMSAT-OSCAR-13 using ROBOT 72-second color. Activity is usually heard during times when the satellite signals are strongest. This is when the satellite's antennas favor the earth. Dave WB6LLO promotes an informal SSTV net for weekend activity via modes B and J (2 meters up and 70 cm down). The "B" downlink is 145.960

via satellite the problem of "skip" is not present. In fact, due to the nature of full duplex satellite activity, you can monitor your own signal as it is being heard by other ground stations. The only disadvantage to SSTV via A-O-13 is the noise. Many stations do not have antenna systems for noise-free copy of SSTV, and since SSTV is a 100 percent duty cycle mode and should not be run at full power on the transmit side, signals are not like the

gest problems encountered are the effects of Doppler shift, causing color changes as frequencies shift, and interference from 15 meter stations not aware of the satellite operation. SSTV gear used by both stations has included the AEA AVT Master Amiga Video Terminal with Commodore Amiga computers. Although superior results might be possible with newer SSTV modes, the short passes have yielded more pictures with the 36-second ROBOT format.

Full-Motion Video

Standard fast-scan television (FSTV) operation via satellite is not currently being considered. The bandwidth required exceeds that available on most bands allocated for amateur radio satellite use. The FSTV experiments to uplink video to the Space Shuttle require FCC permission for the participating stations to send 6-MHz-wide signals to space. The 70 cm uplink band is normally only 3 MHz wide.

For now SSTV is the best way to get images across without using the digital store-and-forward satellites. In the future, work on video-compression techniques will allow nearly full-motion video via hamsat using special modems and digital data at 9,600 to 56,000 bps.

"The advantage of satellite SSTV is the lack of interference. While coverage is worldwide, the congestion is much easier to take than on HF."

MHz and the "J" downlink is 435.980 MHz.

The advantage of satellite SSTV is the lack of interference. While coverage is worldwide, the congestion is much easier to take than on HF. The odds of a station ruining a good picture by tuning up or talking over it are very small. Unlike the shortwave bands where everyone cannot hear each other on a particular frequency,

blockbusters sometimes heard on 20 meters. Consistency of the signals and lack of interference balance the equation.

A-O-13 is not the only satellite passing SSTV signals in the sky. RS-12 is as well. Rick VE4AMU and WA2KUK have been trying ROBOT 36-second color via the mode "K" (15 meters up and 10 meters down) transponder. The big-

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Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Having been involved in radioteletype for many years, it's easy to lose sight of the simple questions with complex answers posed by the newcomer. To wit: Timothy S. Kraus KC4ZGP, of Warner Robins, Georgia, writes that "Lately, I've been watching hams converse in 60 wpm Baudot TTY. I got to thinking, I'd like to talk to folks out there. Do you know where I can find a surplus TTY keyboard? I have the receive side—my Microdec MD-100—I just need a keyboard. I don't have a computer and I hope I won't have to buy one because RTTY keyboards are getting rare."

Well, Tim, there are at least three ways you can go with this. First off, let's define a "RTTY keyboard." The keyboard attached to classic teleprinters such as Model 15s, Model 19s, and Model 32s, is an electromechanical conglomeration of levers, gears, and contacts. It runs both off the electrical circuit built into the machine and via a gear driven by the motor which powers the unit. The rotation of this gear is critical both to move the levers and to provide the timing needed for

the pulses. Thus, an isolated keyboard, without a machine, is relatively useless.

Next up the scale would be a self-contained Baudot keyboard. Using a Programmable Read Only Memory (PROM) or a diode matrix to encode the five level pulses, such a keyboard is a reasonable do-it-yourself project. Over the past 10 years this magazine has carried any number of such construction projects. A search of the 73 indices should turn up a few that you might look at. Trouble is, the blank keyboard used in such projects is becoming a scarce animal. James Electronics, among others, used to have one that was easy to use. Radio Shack used to, but no longer does, to my knowledge. You may be in trouble here in terms of obtaining the needed parts.

The third solution is the one you dread, getting a computer. I know, it seems like overkill. But a small computer, such as a used VIC-20, C-64, or Radio Shack Color Computer, should be available used for well under, well under, a hundred dollars. With suitable programming, any of them would do just fine.

The bottom line is to look around, see what's out there in your area, and

go for it. Whatever you do, why not write it up and share it with the readers of this column, and this magazine? We look forward to hearing from you.

Another letter arrived from Martha Nelson N3MHD, in Milton, Pennsylvania. She tells us that she has been "playing for about 10 months at a packeteering computer. For fun, I bought a 128K Tandy (color computer) . . . I use a Packard Bell (and) KAM for my communications. However, I would love to hear about your experience with the CoCo."

It really hurts me to say this, but you've bought an orphan. An orphan I have loved, an orphan with great potential, a very capable orphan, but an orphan nonetheless. You see, when the first CoCo came out, I was right there in the store, plunking down my cash almost before they unloaded the truck. I had my CoCo 2 running an 80 x 24 display, multiple disk drives, modem, and even multitasking under OS9. When Tandy Radio Shack introduced the CoCo 3, with more memory and better capabilities, we thought, at first, that this was to be an exciting new line. But as they emphasized the PC-compatible line they first neglected, then orphaned, the CoCo.

There are still support groups around, and there are an awful lot of these machines in users' hands. A very active SIG (special interest group) may be found on the Delphi computer network. There may be files elsewhere as well; I just can't find them. Person-

ally, I would use the CoCo as a dedicated terminal in front of a multimode controller, or use one of the available programs to run it in simple RTTY or packet mode. It is usable; it's just going to take some work. I do wish you luck, and I look forward to hearing about your progress.

Several of you have asked for circuits to power your teleprinters. The power supply used supplies a constant current in a loop, normally 60 mA or 20 mA, depending on the machine. At any rate, Figure 1 is an example of one such RTTY loop, which uses transistors as current-controlling devices. This is a good place to start, neither too simple nor too complicated. Maybe next month we will look at another circuit.

We've kept things basic this month, but that is not always the case. I look forward to hearing from you, each and every one of you, to let me know what you want to read about in "RTTY Loop." Reach me by mail, at the above address, or through E-mail on CompuServe (ppn 75036.2501), Delphi (username MarcWA3AJR), or America Online (screen name MarcWA3AJR). The software disks, RTTY and archiving, remain available as well. Each collection, two of RTTY programs and one of archiving programs, may be yours by sending me a high density disk sufficient for 1.3 Mb each, \$2 per disk sent, and a self-addressed stamped disk mailer. Be sure to indicate which collection you would like.

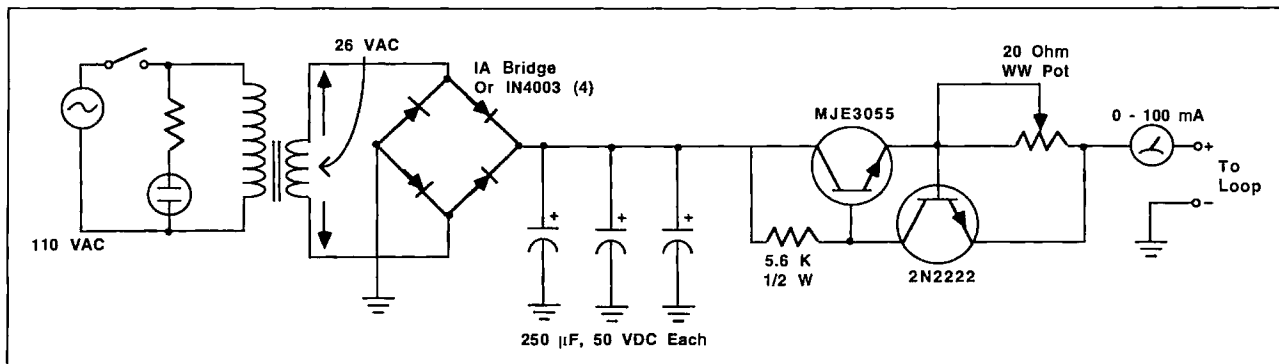


Figure 1. A circuit to power a teleprinter, using transistors as current-controlling devices. The power supply used provides a constant current in a loop, normally 60 mA or 20 mA, depending on the machine.

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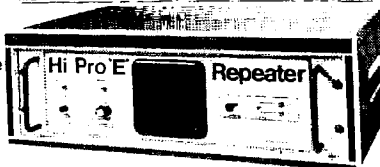
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Teeny-Weeny T's

Newcomers to amateur radio direction finding contests often ask what special transmitters they must obtain to get in on the fun. Actually, the "fox" in a foxhunt or T-hunt, as these events are called, has it easy from an equipment standpoint. Most times, a handie-talkie or a mobile transceiver is all it takes. With enough battery power to last through the event and a source of audio (your voice or some sort of tone box), you're ready to set out in search of a hiding spot.

But the creativity of ambitious hiders sometimes demands special equipment. Last year in Albuquerque, New Mexico, T-hunters puzzled for a long time before they figured out that the hidden T was inside a cola can on a picnic table. On other hunts, this micro-T has been hidden in a hole in the bottom of a fireplace log, buried under a plant, and secreted in a cream cheese container under a rock.

Usefulness of a subminiature transmitter is not limited to competitive foxhunts. Almost every month I receive requests for tiny radio beacons for unusual purposes, ranging from keeping track of coon hounds to motorcycle theft deterrence. Some of these ideas are practical, others aren't.

There have been a few articles in hobby magazines with designs for fly-weight emitters, but they usually are lacking in stability, performance, and ruggedness. That's why I was delighted to encounter Ken Bauer KB6TTS and his radio retrieval devices.

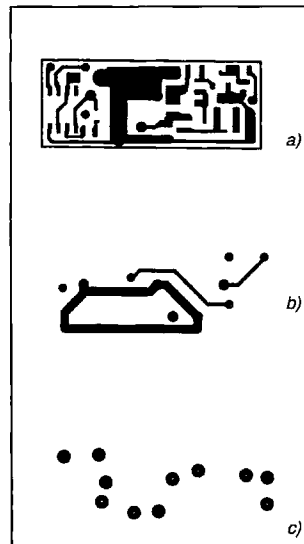


Figure 1. Parts side etch (a), rear side etch (b), and feed-through hole locations (c).

Radio Direction Finding

Where's My Glider?

KB6TTS is an RF engineer at a Southern California aerospace company, with 10 years of experience working with transmitter and receiver circuits. In his spare time, he flies model gliders in the nearby deserts. These 7-foot wingspan craft can travel up to five miles in a typical flight if there are good "thermals" in the air.

Locating his models when they land out of visual range is a frequent and potentially expensive problem, so in the early 1980s Ken started experimenting with radio beacons for recovery.

In the model glider world, every additional gram of weight and ounce of drag is undesirable. Ken's latest glider beacon weighs only 2 grams, not counting the antenna and battery (Photo A). That's about a quarter of an ounce! With a 2-gram 3-volt lithium coin cell (#1225), it puts out a couple of milliwatts peak for about 48 hours. With a larger coin cell (#2032), it can achieve up to 8 milliwatts and transmit for a week.

This long battery life is due in large part to the low transmit duty cycle. A CMOS timer keys the transmitter for 100 milliseconds each second, giving short beeps in Ken's BFO-equipped receiver.

For more RF output power, which is usually desirable on T-hunts, use a standard 9-volt alkaline battery. This gives 25 to 50 milliwatts, but requires different biasing resistor values. The alkaline battery will last a week or more in the pulsed mode.

For glider recovery, the 222 MHz (125 centimeter) ham band is better than 2 meters. High gain beams for the receiver are smaller and there is less broadband noise from Santa Ana winds in the desert to mask the weak signal. Ken's transmitter can be built for either band by proper choice of crystal and tuned circuits.

The KB6TTS beacon board measures only 1.25" by 0.5", small enough for two to fit side by side on an Elvis stamp. Figures 1a and 1b are etch patterns. Front and rear etch are connected together at hole locations shown in Figure 1c. Figure 2 shows the parts placement.

Figure 3 is the schematic of the RF and pulsing circuits. Component values are for 2 meters. For the 1-1/4 meter band, change C2 to 47 pF, C4 to 22 pF, and C6 to 10 pF. Y1 will be 74 to 75 MHz. For operation with a 9-volt supply, change R1 to 10k, R2 to 5.1k, and R4 to 22k.

Ken's design is straightforward and reproducible. "Very hot RF transistors are needed for the unit to work well at low voltage and provide plenty of energy at the third harmonic of the oscillator," he says. "The Motorola MM-BR951L is a good choice because it's

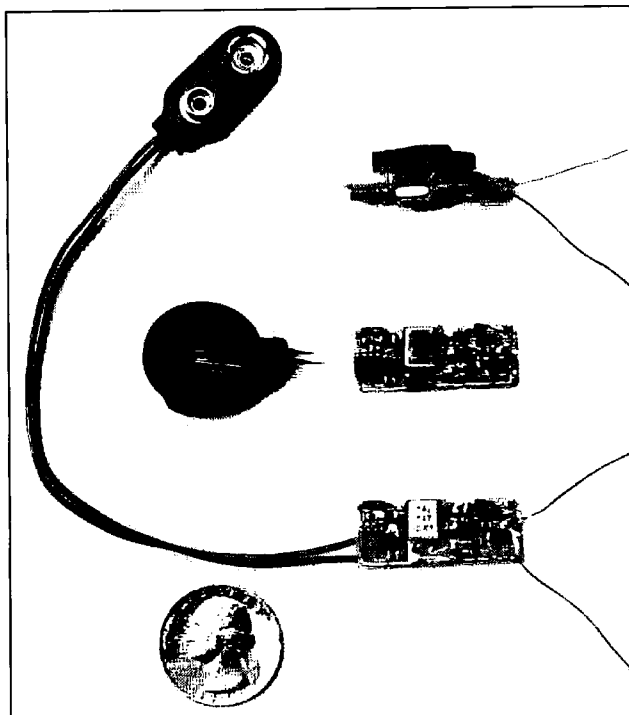


Photo A. It's not hard to find hiding places for these little hidden T's, shown with three options for battery power. Dig-Key stocks the battery holders. Use quarter-wavelength wires as antenna and radial.

inexpensive and has gain up to 8000 MHz." "Q1 forms a Colpitts oscillator with the crystal, C1, and C2," he continues. "The crystal sees the combined capacitance of C1 and C2 as its 20 pF load and itself looks inductive as these elements form the main frequency control tank. L2 prevents the circuit from oscillating on the fundamental frequency of the crystal and keeps it in the overtone mode. The trick is that the oscillator will work only on frequencies where its emitter sees capacitance to ground. The combination of L2 and C2 must be such that they look capacitive at the overtone frequency but inductive at the lower fundamental frequency, thus preventing oscillation there."

Tank circuit L1/C4 is tuned to the transmitter output frequency, making Q1 an oscillator/triplet stage. Q2 is a buffer that amplifies the oscillator output and isolates it from load variations at the antenna. U1 pulses the Vcc supply to Q1 and Q2 with on and off time periods set by R5, R6, and C8. Change these components as you wish to give the right pulsing rate and duration for your application. It is important to use the CMOS version of the 555 timer to maximize battery life.

The crystal is a third overtone type at 2 meters and fifth overtone at 1-1/4 meters. It should be specified for 20 pF load capacitance, series resistance not more than 60 ohms, and frequency tolerance of 25 parts per million or better. Ken gets his from International Crystal Manufacturing (ICM), Oklahoma City, Oklahoma.

Pinhead-Size Parts

If your idea of project-building is dropping component leads through holes in a nice big circuit board and fastening them down with a soldering gun, you will need to change your ways for this project. Making an "Agent 007 size" transmitter calls for the same technology used to make today's pocket-size dual-band handie-talkies. All capacitors and resistors are chip components except R5, which is 1/8-watt carbon. The transistors and IC are in surface-mount packages.

This is definitely not a beginner's project. If you have successfully built a few circuit boards and know your way around VHF RF circuits, you should be able to build and adjust this little rig. Otherwise, seek help from a local technically-inclined ham.

Surface-mount construction may seem a bit scary, but it just means acquiring a few new skills. Set your soldering gun aside and use a fine-tipped iron, 18 to 25 watts. You will also need steady hands, a strong light, a low-power magnifying lens, and a pair of fine-point tweezers.

Once you get the hang of it, soldering a component onto the board is not difficult. Pick up the part with tweezers and "wet" one terminal using the soldering iron and a tiny amount of solder. Use the tweezers to hold the part down on the board in its place, then momentarily touch the iron to the pre-tinned pad to flow the solder and secure the component. Then tack down its other leads, being careful not to overheat the part so that it shifts position on the board.

Bare circuit boards are available for

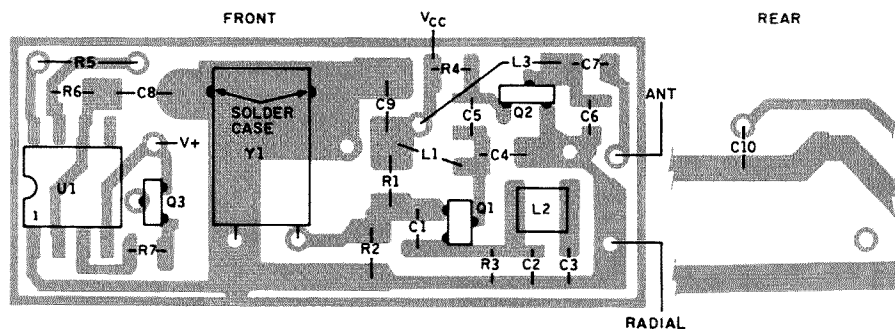


Figure 2. Parts locations for the KB6TTS beacon transmitter. All components except C10 are on the front side.

\$10 each from KB6TTS. Ken is not selling parts kits, but he will build complete transmitters to order as his spare time allows. For information and prices, send a self-addressed stamped envelope to Airtex, 2306 Turquoise Circle, Chino Hills, CA 91709. If you're into flying models, ask for his info sheet that gives tips on aircraft transmitter mounting and retrieval techniques. As usual, here's the disclaimer: These offers are not warranted by 73 Amateur Radio Today or by me.

Q1 and Q2 are available from Motorola distributors. One that sells to individuals is Newark Electronics. Newark has over 200 branch offices across the USA and Canada. Call the main office in Chicago at (312) 784-5100 to obtain a catalog and get the phone number of the nearest branch.

To order a crystal from ICM, call (800) 426-9825. Specify the crystal frequency (transmitter output frequency divided by 3) and part number 471393 for 2 meters or 472393 for 1-1/4 meters. These ICM part numbers

determine the mode, load, series resistance, tolerance, case, and leads.

The remainder of the parts are available from Digi-Key Corporation, PO Box 777, Thief River Falls, MN 56701, phone (800) 344-4539. The resistors are Panasonic thick-film, 1/10-watt, series 0805. The capacitors are Panasonic multilayer ceramic. C3, C8, and C9 are type X7R, and the remainder are type NPO, for low drift. L2 is Toko type 32CS.

L1 and L3 are made from AWG 32 enameled wire, wound over a 0.06"

diameter drill bit, then slipped off and soldered onto the board. Start with the turns close spaced. You will spread the turns as necessary to tune each stage.

Keep Our Spectrum Clean

The primary goal of tune-up is to peak up output on the transmit frequency and minimize output on the fundamental and all other harmonics of the crystal. A spectrum analyzer is the ideal tune-up instrument, but most of us don't have one at home.

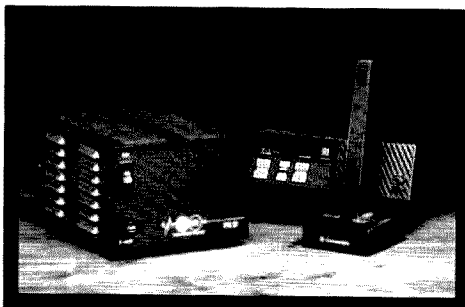
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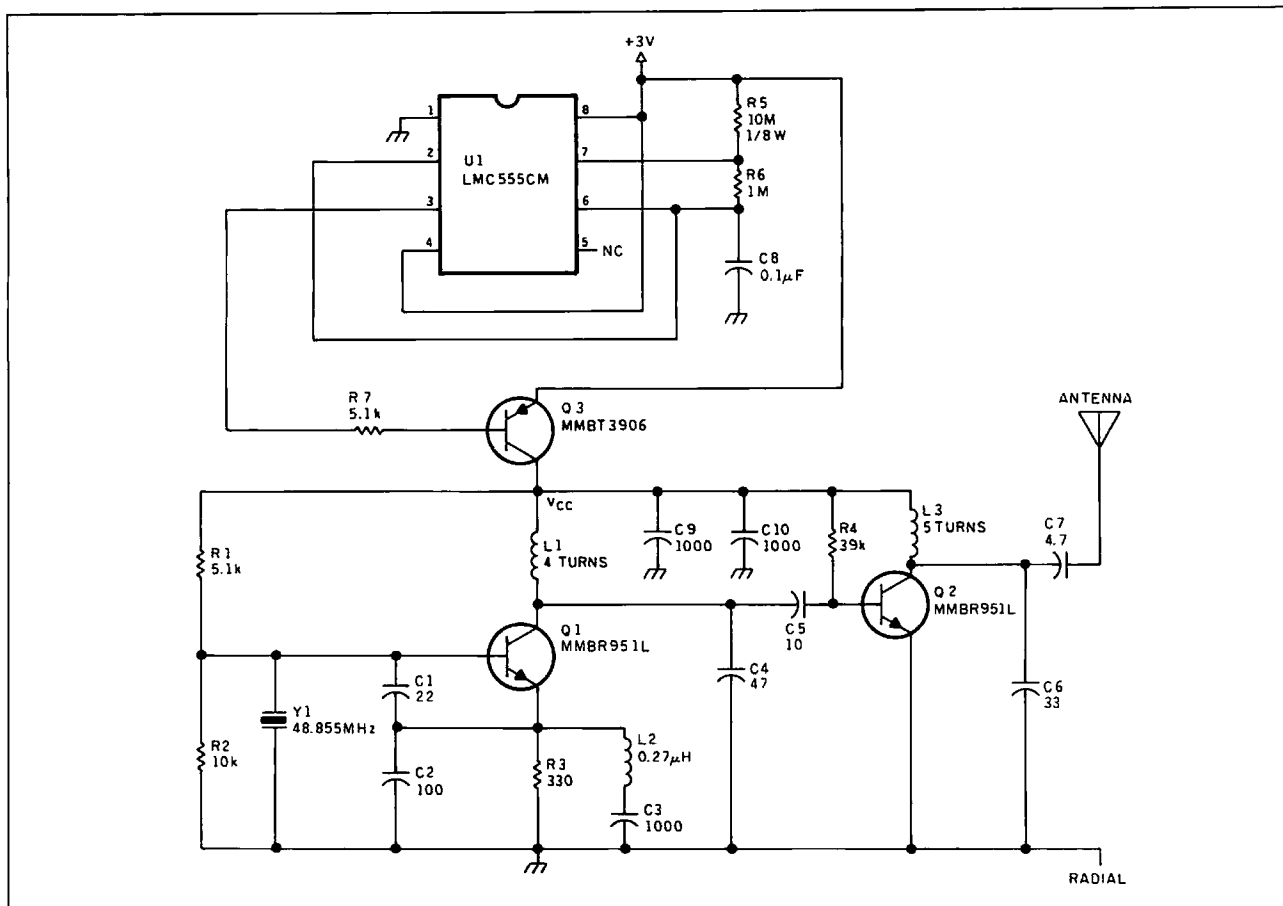


Figure 3. Schematic of the tiny transmitter as built for 146.565 MHz, the Southern California T-hunt frequency. Unless otherwise specified, capacitances are in picofarads. See the text for component changes for the 222 MHz band and for 9V power supply.

With a bit of patience, you can substitute the S-meter of a wide-range receiver.

As an example, the output of a 146.565 MHz unit should be checked at 48.855, 97.710, 195.420, 244.275,

and so forth, tuning to minimize all spurs and maximize the 2 meter signal. Tune-up is easiest with continuous output, so jumper the collector and emitter of Q3 during this process. Whether you use an analyzer or re-

ceiver, connect the mini-T's output to the indicating instrument through a resistive step attenuator, so you are measuring the true output instead of direct radiation from the stages.

Ken's board has no provisions for

ID or modulation. You will want to add these as appropriate for your application. Many CW keying circuits have been published, and they can readily be adapted to key the Vcc line of this rig.

73

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CIRCLE 193 ON READER SERVICE CARD

Your Tech Answer Man

Michael J. Geier KB1UM
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Various Gripes

This month, I'd like to address various small topics which keep cropping up, but none of which warrants an entire column by itself.

Those Darned Batteries

First of all, nickel-cadmium batteries. I've written a fair amount about them, and I've seen various contradictory articles. Frankly, I'm getting sick of the whole thing. Some say the "memory" effect exists, some say it doesn't. Some say that dischargers are a bad idea, others like them. My opinion, once and for all: It may be memory, it may be something else, but whatever you want to call it, NiCd packs don't work very well for very long. After six months or a year, you almost inevitably wind up with one or more weak or shorted cells. Just tonight I had to crack open two \$100 laptop computer packs, each manufactured about two years ago and bought and used only about eight months ago. In both of them, there were a few shorted cells alongside others which were fully charged. That has happened to just about all the NiCd packs I've ever owned, and I follow all the rules. I suspect that the true cause of the failures is charge imbalance.

What seems to happen is this: Because no two cells can be absolutely identical, some discharge faster than others, especially when sitting idle on the shelf. When the pack appears to need recharging, it really has some cells which are only partially discharged. When you charge it up, their higher resistance prevents the weaker ones from getting a full charge. Next cycle, it gets even worse because the weaker ones die even faster due to their having only a partial charge to begin with. Eventually, the weaker ones wind up getting reverse-charged by the stronger ones (during the discharge cycle) and they short out. End of pack. I've had some success with zapping them, but it requires opening the pack, and it doesn't always last.

I've never seen any literature regarding whether you should keep your packs charged or discharged between uses. In light of the above, it might make sense to leave them discharged. That way, they can't slowly sink down to uneven levels while sitting on the shelf; they're all pretty low anyway. I can't verify the wisdom of this approach, but it's a strong hunch. Perhaps that's why

they ship them discharged from the factory.

As for dischargers: Many people pooh-poo them, but they may be wrong. Did you know that Sony is now offering, for their video equipment, optional chargers which include automatic dischargers? Apparently, even *they* are admitting there's a problem with NiCds. I haven't tried a discharger, so I can't say for sure whether they actually work. Even if they can't fix a bad pack, at least they let you charge up your pack whenever you want to, ending the frustration of having only half a charge because you're afraid to charge up a partially charged pack.

I don't want to write about NiCds anymore. As I've said before, the only ones which have worked fairly well for me are those made by Sanyo. They seem to hold a charge much longer while sitting idle, and that may have something to do with it. Hopefully, the new nickel-metal-hydride cells or some other new kind of battery technology, such as the up-and-coming rechargeable lithium cells, will obsolete the old stuff once and for all. End of topic. Please.

Open Wide

If you've ever spent any time on the 20 meter band, you've heard squabbles arising over somebody with excessive bandwidth. Just yesterday I heard one such argument, including (and this is a direct quote), "I don't think my 50 watts could be that wide." Folks, your bandwidth has *nothing* whatever to do with how much power you are putting out. You could be running 100 milliwatts and still be 10 kHz wide!

We're all supposed to be no more than 3 kHz wide, unless we're running AM or FM. On AM, we can be 6 kHz wide, and on FM even wider. That's why FM is not allowed below 10 meters. Ten's a big band, so there's room for wider stations. The lower bands are just too small.

AM

There are some people who run AM on 20 meters. In fact, there's an entire net of them. Personally, I find the idea inconsiderate but, hey, they are allowed to do it, so until the rules change, we'll all have to live with it. Luckily, they tend to stick to one frequency, so it really isn't all that big a deal.

The problem is that most AM transmitters are far wider than 6 kHz! To stay within that limit, the audio response must go no higher than 3 kHz, just like on any other mode. Compounding the circumstance that most of these transmitters are very old, and have no filtering to prevent

them from being too wide, is the fact that many users go out of their way to get microphones with what they call "broadcast quality" sound. In other words, lots of high frequency response! Many AMers take a great deal of pride in sounding hi-fi (and say so on the air), while conveniently ignoring, and sometimes denying, the resulting bandwidths of their signals. Folks, you can't have the crisp, commercial-quality highs without the bandwidth.

SSB

But before it sounds too much like I have it in for AMers, which I really don't, let me say that plenty of SSBers also are too wide. There are several reasons, but the most common one is the over-adjustment of speech processors. Lots of hams, and especially DXers, turn them up to the point of pain. I've probably done it myself a few times, but it isn't hard to avoid. If you have an IF monitor button on your rig, plug in a pair of headphones and listen to what you're putting out. If it sounds overly peaky and distorted, back it down a little! If you don't have a monitor, have a friend listen up and down the band to see if you're within proper bandwidth limits. This works best from the range of a few miles, rather than from across the country. But even that is better than nothing. Above all, though, if people complain that you're wide, don't get defensive. Check it out; they may be right.

The reason high power is associated with excessive bandwidth is that it is really easy to overdrive a linear amplifier and cause signal-widening distortion. Using the amp's ALC line can help prevent it, but not completely. Some amps just aren't all that linear to begin with. But, a good clean amp with the right drive will be no wider than the signal driving it. And even a QRP rig can have excessive bandwidth if you let it.

There's another reason for SSB rigs' being too wide, and this one is no fault of the operator. While it is true that today's rigs have audio filters which roll off above 3 kHz, they don't have terribly steep skirts. In other words, some of the higher frequencies do get through. Most of the filtering action occurs at the SSB filter in the transmit IF stage.

SSB rigs have two adjustments, one for each sideband, which set the frequency of the carrier before it is suppressed in the balanced modulator. These frequencies are chosen to coincide with the filter skirts such that no opposite sideband or residual carrier energy get through the filter. Typically, the adjustments are trimcaps connected to crystals in fixed crystal oscillators. In older rigs which did not have IF shift or variable bandwidth tuning functions, adjusting the oscillators caused the entire rig to shift in frequency. Many newer radios shift the first local os-

cillator to track the carrier oscillator. (And you don't need digital synthesis to do it; heck, my old TS-120 did it with a PLL circuit, even though it had an analog VFO.) Doing that has the effect of changing the passband without detuning the radio, which is exactly what you want when you turn your IF shift or VBT control. What most people don't realize, though, is that it can happen in transmit as well as in receive.

Obviously, the IF shift control disappears in transmit. But what if the oscillator is off to begin with? If it is set too far toward the low end of the filter's response, the radio may radiate carrier or opposite sideband. If it is set too high in the response, there'll be lots of audio highs and the RF signal will be too wide.

Over time, these oscillators drift. If your rig is on frequency but the sound quality differs markedly between USB and LSB, you may have this problem. It doesn't take much more than 50 Hz drift to do it! Correcting it requires a frequency counter. If you have a sharp ear, you can make it better just by matching the sounds of the two sidebands while listening to background static. Don't expect them to be identical, though; the two carriers are coming at the filter from opposite sides of its passband, and no filter is perfectly symmetrical. By the way, the by-ear approach works best when only one sideband is obviously off. If they're both off, you have no way to know where they belong.

There are some people who deliberately set the carrier oscillators to make their rigs sound "punchy" and "hot." What they're doing, of course, is reducing the bass and increasing the highs. If you do it, you will annoy other amateurs and violate FCC rules with your wide-as-a-bam-door signal. It is far better to have the carriers set properly and then use a punchier microphone or a little speech processing to get the sound you want. It is possible to sound crisp and punchy within 3 kHz. Up to a point, anyway.

SSTV

SSTVers take a lot of flack from voice operators. Some lids go as far as causing deliberate QRM to those exchanging pictures. Often, I've heard cracks about "all that splattering noise interfering with us." In truth, SSTV tends to be a bit *narrower* than the allowed 3 kHz. The audio frequencies used to modulate the transmitter are carefully controlled, and they're sine waves. All in all, a much cleaner signal than what comes from our vocal cords. I can tighten the slope tuning on my TS-940 to the point where voice signals are hard to understand, without affecting SSTV reception. So how about giving these folks a little slack, OK?

Well, I guess I've griped enough for one session. Next month, something positive, I promise!

Number 16 on your Feedback card

*Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check **Special Events File Area #11** on our BBS (603-924-9343). For listings that were too late to get into publication.*

MAY 1

GLEN ELLEN, CA The Valley of the Moon ARC (WB6DWY) will hold its semi-annual Hamfest at the Sonoma Developmental Center, 15000 Arnold Dr., at McDougal Cottage, next to the fire station. Swapmeet, VE Exams, Ham and Egg Breakfast, SE Station, and more. Talk-In on 147.47 simplex and the 145.35 (-600) Rptr. For info call *Darrel WD6BOR, (707) 996-4494.*

MAY 2

SOUTH BEND, IN A Hamfest Swap & Shop will be held in PARKING GARAGE Downtown on U.S. 33 ONEWAY North by the Society Bank Bldg. and Century Center, across the street from Winter Hamfest. Talk-in on 52-52, 99-39, 69-09, 34-94, 145, 29. Contact **Wayne Werts K9IXU**, 1889 Riverside Dr., South Bend IN 46616. Tel. (219) 233-5307.

MAY 3

ROCK SPRINGS, GA WCARS/VEC Exams will be held at Walker County (GA) Civic Center, US 27 Hwy., beginning at 7 PM. Pre-register with *Alan Painter* WA4QCH, (404) 866-1200, or *Dale Har-*

wood N4VFF. (404) 937-5680.

MAY 8

MANITOWOC, WI The MancoRAD RC will hold its annual Hamfest beginning at 8 AM at the Manitowoc County Expo Ctr., intersection of Hwys. 42-151 and I-43 on Co. Hwy. R. Flea Market. VE Exams. Pre-register with SASE to *MancoRAD RC, P.O. Box 204, Manitowoc WI 54221-0204*. For Info, call *793 (414) 684-9097* days, or *Ron (414) 793-4733* evenings.

MIDDLESBORO, KY Stop in at the Middlesboro City Library for WCARS/VEC Exams at 10 AM. To pre-register, contact *Andrew A. Pitt* WB8WEZ, (606) 248-0046, or *James E. Dyke* KZ8A, (615) 869-4453.

MURFREESBORO, TN The Middle Tenn. DX ARC will sponsor the Murfreesboro TN Hamfest from 8 AM-4 PM, indoors at the Rutherford County Agriculture Center, Old Fort Pkwy. (HWY 96); one mile east of I-24 Exit 78. ARRL sanctioned. Contact *Jerry Sartin KC4ALG, President MTDXARC. Tel. (615) 890-9358.*

MAY 8-9

AMARILLO, TX The Panhandle ARC will sponsor the Golden Spread Hamfest 8

AM-6 PM Sat., and 8 AM-2 PM Sun., at the Amarillo Civic Center, 3rd and Buchanan. Talk-in on 146.67 (-600). Contact *Lettie Hahn*, (806) 358-7115.

MAY 9

ATHENS, OH The Athens County Area will hold its 14th annual Hamfest from 8 AM-3 PM at the City Rec. Center. To register in advance, contact **John Biddle WDBJLM**, 80 Wonder Hills Dr., Athens OH 45701. Tel. (614) 594-8901 after 6 PM. Talk-in on club repeater at 145.15+ MHz. For general info, write to **Carl J. Denbow KA8JXG**, 63 Morris Ave., Athens OH 45701-1939

MAY 14-16

TULSA, OK The 1993 Green Country Hamfest and ARRL Oklahoma Section Convention will be held at the Maxwell Convention Center, W. 7th St., between Denver and Houston Aves. VE Exams. Talk-in on 146.28/.88. Call (918) 272-3081, or write P.O. Box 470132, Tulsa OK 74147-0132, for info. Sponsored by Green Country Hamfest Inc.

MAY 15

AMENIA, NY A Hamfest sponsored by

the Southern Berkshire ARC will be held from 8 AM-2 PM at the Amenia Firehouse on Mechanic St. Talk-in on 147.285+. Contact **WB1CEI**, (203) 364-5266 or **N1GIS**, (203) 364-5976.

CADILLAC, MI The Wexaukee ARC will hold its annual Swap 'N Shop and Eyeball QSO at the Cadillac Middle School starting at 8 AM. Talk-in on 146.98 Rptr. Contact *Wexaukee ARC, P.O. Box 163, Cadillac MI 49601*, or call *Dan Schmidt KE8KU, (616) 775-0998*.

COLORADO SPRINGS, CO A Ham Radio/Computer Swapfest will be held by the Pikes Peak RAS, from 8 AM-4 PM at the City Auditorium, 221 E. Kiowa at the corner of Weber St. Talk-in on 146.971.20. For general info, call **Doug Paris N4TGO**, (719) 495-9346. VE Testing 9 AM-1 PM; call **Rick Brown KD0SU**, (719) 531-9423 for details. To reserve tables, contact **Dennis Ochs N7OGL**, 850 Santa Fe St., Colorado Springs CO 80903. Tel. (719) 630-0704.

CROSSETT, AR A Hamfest & Crafts show will be held from 8 AM-4 PM at the Nat'l Guard Armory on Bus Route 133, Florida St. Sponsored by the Southeast Arkansas ARC. VE Exams at 10 AM. Talk-

Took 10, 15, 20, and 40 meter HalfSquares on Field Day. They went up in the trees as easy as dinoloes. A low GSRV took care of everything close and the HalfSquares made my QRP a big signal for the long hop east and west. On 10 and 15 I thought I had a conduit. Try a HalfSquare!

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

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N. SMITHFIELD, RI The R.I. Amateur FM Rptr. Serv., Inc., will hold their annual Spring Auction & Flea Market starting at 8 AM at the VFW Post 6342, Main St., in Forestdale. The Auction will be from 11 AM-3 PM. Talk-in on 146.76. Contact **Rick Fairweather K1KYI**, 106 Chaplin St., Pawtucket RI 02861. Tel. (401) 725-7507 between 7-8 PM.

ROANOKE, VA There will be WCARS/VEC Exams for upgrades only, beginning at 9 AM. Pre-register with **Fred L. Horton KZ4Y**, (703) 366-6266 or **Ben Giavaden N4BG**, Route 7, Roanoke VA 24022.

SELAH, WA A Hamfest will be held by the Yakima ARC (W7AQ), at the Selah Middle School Gym from 8 AM-5 PM. Talk-in on 146.66, 444.800 and 146.52 simplex. The 2nd Northwest Packet Forum will be held at 9 AM. VE Exams at 10 AM. Potluck Picnic Sun. at Noon. Contact **K7FZS**, (509) 697-8080 (non fax), or **N7HHU** via packet at YKM.

MAY 16

CAMBRIDGE, MA A Tailgate Electronics/Computer/Amateur Radio Flea Market will be held from 9 AM-2 PM at Albany & Main Sts. Talk-in on 146.52 and 449.725/444.725 pi 2A (W1XIM) Rptr. Sponsored by the MIT Radio Soc. and the Harvard Wireless Club. Reservation deadline May 4th. Contact (617) 253-3776.

HAGERSTOWN, MD The 1993 Great Hagerstown Hamfest, sponsored by Antennas Radio Assn. (W3CWC), will be held

from 8:30 AM-3:30 PM at Hagerstown Jr. College Athletic & Rec. Center. For reservations contact **Fred Bailey N3HTN**, Hamfest Chairman, (301) 416-8079. VE Exams may be given by the Mountain ARC-VEC; for info call (304) 289-3576 or (301) 724-0674. Talk-in on the Hagerstown 146.34/94 Rptr.

OLD WESTBURY, NY The L.I. Mobile ARC will hold an outdoors Hamfest at the New York Inst. of Tech., Route 25A. VHF Tune-up Clinic. Talk-in on 146.25/85. Contact **Neil Hartman WE2V**, (516) 462-5549.

WHEELING, WV The Triple States RAC will sponsor the 1993 TSRAC Wheeling Hamfest/Computer Show from 8 AM-3 PM at the White Palace, Wheeling Park. ATM demos. Seminars. Talk-in on 146.91. Contact **The Triple States RAC**, Box 240, RD #1, Adena OH 43901. Tel. (614) 546-3930.

MAY 20-22

RACINE, WI The Racine Hamfest and Big Boy's Toy Show, sponsored by Racine Megacycle Club (W9UDU), will be held in downtown Racine, On the Lake, Hwy. 20 East from I-94. Time: Fri. May 20th, 5 PM-9 PM; Sat. May 21st, 8 AM-7 PM; Sun. May 22nd, 8 AM-5 PM. Vendors call **Rory or Kelly**, (414) 636-9271. ARRL/VEC Exams Sat. 9 AM-11 AM. Talk-in on Lakeshore Rptr. 147.27.

MAY 21

ELIZABETHTON, TN Western Carolina AR Society/VEC, Inc. will sponsor VE Exams at Moody Aviation-Carter County Air-

port at 7 PM. Pre-registration only. Contact **Joe Hopkins K4BK1**, (615) 543-4022 or **Jon Christiansen AB4NN**, (615) 543-7155.

MAY 21-22

SO. SIOUX CITY, NE The 3900 Club and the Sooland ARA will sponsor Hamboree 15 at the Marina Inn. Flea Market. Convention. Bus Tour. QCWA Luncheon. MARS, and more. Flea Market contact: **Al Smith WOPEX**, 3529 Douglas, Sioux City IA 51104. Tel. (712) 258-7475. Convention/Banquet contact: **Dick Pitner WOZQ**, 2931 Pierce St., Sioux City IA 51104. Tel. (712) 258-1520.

MAY 22

EPHRATA, PA Lancaster County Hamfest sponsored by the Ephrata Area Rptr. Soc., Inc., will be held at the Ephrata Sr. High School, 803 Oak Blvd., starting at 8 AM. VE Exams at 9 AM. Contact **Tom Youngberg K3RZF**, (215) 267-2514 after 6 PM, or write to E.A.R.S., 906 Clearview Ave., Ephrata PA 17522. Talk-in on 145.45 and 444.650 MHz.

GRAND RAPIDS, MI The Independent Rptr. Assn. will hold its 13th Annual Hamfest at Wyoming Nat'l Guard Armory, 44th St.; 1/2 mile west of the 131 x-way. Hours: 8 AM-4 PM. Talk-in on 147.160 Link System. Contact **Tom or Kathy Werkema K8BYM/K8BKZ**, (616) 698-6627.

MINNEAPOLIS, MN There will be a Tailgate Swapfest from 7 AM-2 PM at the Honeywell Ridgway plant parking lot, 2600 Ridgway Pkwy., Stinson Blvd. Contact **Bill Brisley N0BSN**, 18025 Cynthia Dr., Min-

netonka MN 55343. Tel. (612) 474-0118. Sponsored by TwinsLAN ARC.
PADUCAH, KY Come to the Noble Park Civic Center to enjoy a Hamfest sponsored by the Paducah ARA. Time: 8 AM-2 PM. Talk-in on 147.06/66. VE Exams. Contact **David Fraser KQ4IU**, 5715 Blandville Rd., Paducah KY 42001. Tel. (502) 554-7999 or **Paul Smith N4FFO**, 229 Nickello Hts., Paducah KY 42001. Tel. (502) 898-6834. Packet address @W4NJA KY,USA,NA.

MAY 23

CANFIELD, OH The Twenty over Nine Radio Club will hold its 9th Annual Computer/Electronic Hamfest from 8 AM-3 PM at the Canfield Fairgrounds on Fairgrounds Blvd. Flea Market. Talk-in on 147.315+, 443.225+ or 223.5 simplex. Contact **Don Stoddard**, 42 South Whitney Ave., Youngstown OH 44509.

MAY 28-30

EDMONTON, ALBERTA, CANADA Northern Alberta Hamfest 93, sponsored by the Northern Alberta RC, will be held at Shakers Acres RV Park, 21530 - 103 Ave. Contact **Jim Steene VE6JDS**, 9319 - 95 St., Edmonton, Alberta T6C 3X1 Canada. Tel. (403) 469-2595.

MAY 30

CHICAGO, IL The Chicago ARC Hamfest will be held from 8 AM-3 PM at DeVry Inst. of Tech., 3300 N. Campbell. Flea Market. Walk-in VE Exams by Great Lakes VEC. Talk-in on 147.255+ 107.2, 444.825+. For info call (312) 666-1606 or (312) 545-

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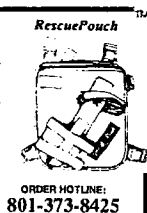
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et on 144.930.

SOREL-TRACY, QUEBEC, CANADA "Hamfest du Quebec" will be held at the Curling Club located in Tracy. Contact Club Radioamateur Sorel-Tracy Inc., Boite Postale 533, Sorel Quebec, J3P 5N6 Canada.

WEST FRIENDSHIP, MD The Maryland FM Assn., Inc. will host its Memorial Day Hamfest at the Howard County Fairgrounds, Route #144, from 8 AM-3 PM. Flea Market tables by pre-registration only. Contact Melvin Seyle WA3KZR, 15809 Pointer Ridge Dr., Bowie MD 20716. Tel. (301) 249-6147. Talk-in on 146.16/76, 223.16/224.76 and 449.0/444.0 WA3DZD Rptr.

JUNE 5

KITCHENER, ONT, CANADA The Central Ontario AR Fleamarket will be held at Bingham Park. Contact Jack Knight VE3RGY, 35 Brockville Ave., Guelph, Ont. Canada N1E 5X5. Tel. (519) 823-1358.

KNOXVILLE, TN The RAC of Knoxville will present its 27th Annual Amateur Radio and Computer Fair at the Tenn. Valley Fair Grounds, 8 AM-4 PM. Talk-in on 147.300+, 224.500-. For VE Exams, contact Rich Slover ND4F, (615) 539-4821. Ticket/table contact: Angela Crigger N4RPR, 2707 Pine Hill Dr., Knoxville TN 37932. Tel. (615) 694-9071.

TEANECK, NJ The Bergen ARA will hold its annual Spring Hamfest from 8 AM-2 PM at Fairleigh Dickinson Univ. VEC Ex-

ams. Flea Market spaces by pre-registration only. Talk-in on 146.190/790 and 145.620 simplex. For Hamfest info call Jim Joyce K2ZO, (201) 664-6725. Get VE info from Pete Adely K2MHP, (201) 796-6622. Please, no calls after 10 PM.

JUNE 6

BUTLER, PA The BreezeShooters of Western PA will sponsor their 39th Annual Computer/Hamfest from 8 AM-4 PM at the Butler Farm Showgrounds. Mobile Check-In on 28.495 and 146.520. Talk-in and directions available on 147.96/36. Fly-in available at Roe Airport. Contact Rey Whanger W3BIS, Box 8, R.D. 2, Cheswick PA 15024. Tel. (412) 828-9383.

DAVISVILLE, NH The Contoocook Valley RC Ham Radio/Computer/Electronics Tail-Gate Flea Market will be held from 8 AM-3 PM. Talk-in on 146.895 K1BKE Rptr. Contact John C. Moore, (603) 746-4817.

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Park, 47-01 111th St., beginning at 9 AM. Talk-in on 444.200 WB2ZZO Rptr., or 146.52 simplex. Call evenings only: Charles Becker WA2JUU, (516) 694-3955 or Arnie Schiffman WB2YXB, (718) 343-0172.

SPECIAL EVENT STATIONS

MAY 1

MEMPHIS, TN The Mid-South ARA will operate W4EM 1500Z-2200Z to celebrate the Memphis in May Internat'l Festival in honor of Russia. Operation will be in the lower 50 kHz of the SSB General 40m-

12m, and the Novice 10m subbands. AMTOR frequencies: 21.080, 14.100, 7.080 and 3.580 MHz +/- QRM. For a certificate, send QSL and a 9" x 12" SASE to MARA-W4EM, c/o Pat Lane, 3390 Northwood Dr., Memphis TN 38111.

SPRINGFIELD, IL The Sangamon Valley RC will operate W9DUA 1400Z May 1-2200Z May 2, to commemorate the 5th anniversary of the dedication of the Illinois Vietnam Veterans Memorial at Oak Ridge Cemetery. Operation will be in the General portions of the 160m thru 15m bands to include the Novice 10m subband. For a special QSL card, send a letter size SASE to W9DUA SPL EV, Sangamon Valley Radio Club, Red Cross Bldg., 1025 S. 6th, Springfield IL 62707.

MAY 1-JUNE 30

VICTORIA, BC, CANADA The Friendship ARS of Victoria will celebrate the 1993 Friendship Radiosport Games and Hamfest by operating XO7G daily at 2100Z-0500Z in the General class subbands. QSL direct or by bureau. For details, contact FARS-Victoria, c/o Camosun College Box 128, 3100 Foul Bay Rd., Victoria BC, V8P 5J2 Canada. Visitors may operate a Field-Day SE Station June 26th & 27th.

MAY 6-7

KAYSVILLE, UT The Davis High School ARC will operate KG7TE 1600Z-2200Z to celebrate the beginning of summer vacation. CW: 14.050, 21.050, 28.050; Phone: 7.285, 14.285, 21.285, 28.375, 145.59. For a certificate, send SASE to Sara Ot-

tersen KB7OTZ, 1549 N. Honeybee Circle, Farmington UT 84025.

MAY 8

CARTHAGE, TX Carthage AR Service, Inc., will operate N5IKS 1400Z-2100Z from the Tex Ritter Museum, near the middle of the 40, 20 and 15m General level and 10m Novice bands. For a certificate, send your contact number, QSL card and business size SASE to N5IKB, 221 Browning St., Carthage TX 75633.

LONDON, ONT, CANADA The London ARC, in conjunction with The London Midlex Red Cross, will operate CJ3RCL (VE3RCL) in support of World Red Cross Day. Operation will begin at 0000 UTC on 75m around 3.810 MHz, changing every 2 hrs. Frequencies: 3.810, 7.210, 14.270, 21.270, 28.270 +/- QRM. For details, write to Canadian Red Cross, 840 Commissioners Rd. East, London Ont., Canada N6C 2V5, Attn: Joyce.

MAY 8-9

BOSTON, MA The Massachusetts QSO Party will be conducted by the Boston ARC, under the leadership of the Council of Eastern and Western MA Radio Clubs. Time: 1500Z Sat.-2100Z Sun. Write to Massachusetts QSO Party, Boston ARC, P.O. Box 15585 Kenmore Station, Boston MA 02215.

LAS VEGAS, NV The Nevada QSO Party will operate 0000Z May 8-0600Z May 9, on 6 through 160 meters. Modes: CW, SSB, RTTY, SSTV, Packet. Sponsored by the Frontier ARS. Contact Jim Frye NW7O, 4120 Oakhill Ave., Las Vegas NV 89121.

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CIRCLE 58 ON READER SERVICE CARD

MAY 10

PROMONTORY, UT The Ogden ARC will operate NL7JE to commemorate the driving of the Golden Spike at Promontory Summit UT. Operation will be from 0001Z-2100Z on one of the following: 3.970, 7.270, 14.280, 21.375 and 28.415 MHz. Send QSL and SASE to *Ogden ARC, P.O. Box 3353, Ogden UT 84409*.

MAY 15

FORT WALTON BEACH, FL The Play-ground ARC will operate W4ZBB from the Air Force Armament Museum, to give an Armed Forces Day salute to U.S. troops. Operation will be 1600Z-2200Z in the General portions of 40, 20, and 15m and in the Novice phone portion of 10m. For a certificate, send business size SASE and contact number to *PARC, P.O. Box 873, Fort Walton Beach FL 32549*.

PASADENA, MD The 149th Anniversary of the telegraph message "What Hath God Wrought," will be commemorated by the Bay Area ARS through the operation of KB3MF, 1300 UTC-2000 UTC, from the Baltimore/Washington area. CW frequencies: 7.125, 14.035, 21.145, 28.245 MHz. Send your QSL card and QSO details along with an 8 1/2" x 11" SASE, to *Ray Robley, Bay Area ARS, 211 Laurel Rd., Linthicum Hls. MD 21090*, to get a certificate.

MAY 15-16

ST. CHARLES, MO Station WB0HSI will operate 1300Z-2100Z as part of the Lewis and Clark Rendezvous commemorating

the departure of the Lewis and Clark Expedition on 21 May 1804. Frequencies: 7.265, 14.265, 21.365, 28.465, 146.67. AO-13 Modes B and J, as propagation and QRM permit. For a certificate, send a 9" x 12" SASE to *St. Charles ARC, P.O. Box 1429, St. Charles MO 6332-1429*.

WALL TOWNSHIP, NJ The Ocean-Monmouth ARC will operate 1600Z May 15-1600Z May 16 to commemorate the Marconi Memorial Tower Radio Site. CW will be up 10 kHz from bottom of Novice subbands and 10.145, 14.045, 18.080 MHz and bottom of General 80-15m and Novice 10m phone subbands. For certificate send a 9" x 12" SASE (or \$1 U.S.) to *OMARC, P.O. Box 75, Bradley Beach NJ 07720*.

MAY 15-17

OAK PARK, MI The 1993 Michigan QSO Party will be sponsored by the Oak Park ARC, 1800Z Sat. May 15-0300Z Sun. May 16, and from 1100Z Sun. May 16-0200Z Mon. May 17. Contact *Mark Shaw KBED, 27600 Franklin Rd., Apt. 816, Southfield MI 48034*.

MAY 16-17

HANSKA, MN The New Ulm ARC will operate KB0IUV 1600Z-2359Z May 16th to celebrate Hanksa's 9th annual Syltende Mai, and on May 17th to commemorate the anniversary date (1814) of the Constitution of Norway. Tune in on 3.875, 7.250, 14.250, 21.350, and 28.350 +/- For a certificate, send QSL and a 9" x 12" SASE with two first class postage, or a

#10 SASE for a folded certificate to *KB0IUV, NUARC, RR4, Box 14-A, New Ulm MN 56073 USA*. SWL reports welcome.

MAY 17-22

DAVIS MTNS., TX Amateur astronomers/hams representing the Southwest region of the Astronomical League, will operate K5GH at the 12th annual Texas Star Party. Frequencies: (+/- QRM): 28365, 21365, 14265 and 7265. SSTV and CW contacts on request. For an astronomical theme QSL card, send QSL/SWL report and SASE to *K5GH-TSP, 2619 Bordeaux, McKinney TX 75070*.

MAY 21-23

LIBERTY, NY The Long Island Mobile ARC's Junior Operators Committee will operate K2YEW from their QRP camping weekend at Mongap Pond Camp grounds. Frequencies: 7.040, 3.560 CW and 7.225 phone. For certificate, send SASE to *Robert Todaro N2JIX, 2218 E. 73rd St., Brooklyn NY 11234*.

MAY 22-23

SUMTER, SC The Sumter ARA will operate WA4UMU from the Swan Lake Iris Gardens, to commemorate the Sumter County Iris Festival. Operation will begin at 1700 UTC and continue for 24 hrs. on the General Portion of 80, 40, 20 and 15m; and on the Novice portion of 10m. For a Certificate, send QSL and 9" x 12" SASE to *KC4SZG* call book address.

MAY 29

DECATUR, AL Station AB4RE will be operated by the Morgan County ARC to commemorate the Alabama Jubilee Memorial Day Weekend celebration at Point Mallard Park. Time: 0900-2100 CST. Operation will be in the General portion of the 40m band and the Novice portion of the 10m band. For a Certificate, send QSL and a 9" x 12" SASE to *AB4RE, Steve Simmons KD4KTV, 1603 1st Ave. SW, Decatur AL 35601*.

MAY 29-30

LOGAN, UT Members of the Bridgerland ARC will operate N7LMO 1600Z May 29-0200Z May 30, to celebrate the Mountain Man Rendezvous commemorating the early Mountain Men and Indian fur trading rendezvous. Operation will be in the Novice 10m phone subband and in the lower 25 kHz of the General 15 and 20m phone subbands. For certificate QSL send 8 1/2" x 11" SASE with 2 oz postage to *Dean Stevens, P.O. Box 332, Millville UT 84326*.

MAY 29-31

WELLSBORO, PA Tioga County ARC will operate WO3C 1500Z May 29-1700Z May 31, to celebrate the 100th Anniversary of the Pennsylvania State Park System. Operation will be on the lower portion of the General 80, 40, 20, and 10m bands and Novice 80, 40, 20, 10m bands. For QSL and Certificate, send QSL and 9" x 12" SASE to *Darlene Rahn WO3C, R.D. #6 Box 200, Wellsboro PA 16901*.

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Of all the skills that get taught in a classroom, concentration and following directions are most often overlooked. Perhaps with the rise of technological advances in information storage and retrieval there is a decline in emphasis on the basic memory and concentration skills. As a teacher of amateur radio in the classroom to 6th, 7th and 8th graders, I am appalled at the lack of ability of many students to focus on a task, concentrate, and to follow directions. I am forever pointing out how much time we waste redoing work that was hastily rushed through without thought.

Fortunately, amateur radio in a classroom gives the instructor ample opportunity to train youngsters (and adults as well) to improve their auditory and concentration skills. The very first time I hand out code prac-

tice oscillators to a class is when the first lesson of "listening" occurs. In an average class of 40 youngsters, the children will get 20 keys to practice on, using the "buddy system." They are literally forced to listen to just the person sitting next to them, and to block out everyone else's tones. I smile to myself as they inevitably get very frustrated and try to convince me that it's impossible to hear only their neighbor with so much other "noise" going on all around them. I keep reassuring them that with total concentration they will definitely be able to hear each other.

Of course, as their auditory and concentration skills improve during the term, most of the children become quite good at being able to distinguish particular tones. I remind them periodically about how far they've come. It's a great motivation to do better when someone realizes that with appropriate effort they can master new skills.

By the end of the term, almost every student has improved his or her ability to concentrate solely on their

neighbor's messages, to the exclusion of the other children's sounds and the distractions coming from the hallway outside our room. This exercise is just one example of the "hidden" benefits the children get in a ham radio class. It doesn't matter that every student won't pass their code test; that's okay. What does matter is that in all of my 12 classes, every child will have gotten more self esteem by acquiring basic tools that are needed to be successful in all their studies.

Following Directions

Before we get to the part of the term where some of the youngsters will be filling out the FCC license application, we have an entire lesson devoted to following directions and carefully reading written instructions. (Another valuable lesson!) Because I always like the more tedious lessons to have a little "zip" to them, I make my point about the importance of following directions and reading everything carefully through a little fun activity. I believe that the lessons the children learn through a need-to-know situation or an amusing demonstration will be well learned and well retained.

The following is the "test" paper that I have waiting on everyone's desk when they enter the room. I don't say anything to them. On the



Photo A. Using Morse code in the classroom can improve auditory and concentration skills.

board is written, "This is a timed test—you have only five minutes. Good luck!"

1. Read everything carefully before doing anything.
2. Smile, then sit back comfortably for the next five minutes.
3. Circle the word "everything" in instruction #1.
4. Brush away an imaginary fly. Blink four times.
5. Sign your name after instruction #1.

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6. Mentally subtract 19 from 26 and extend as many fingers as there are digits in the answer.

7. If 9 is divisible by 3, touch your head while you count silently to 11.

8. Draw a rectangle around the word "doing" in instruction #1.

9. Loudly call out your name when you read this instruction.

10. On the reverse side of this paper add 8,457 and 9,063.

11. Put a circle around your answer for #10.

12. If you think you have followed directions carefully to this point, call out loudly, "I have."

13. Cross your left ankle over your right ankle. Then uncross your ankles and slap your right heel.

14. In a low whisper, count backward from 10 to 1.

15. Punch three holes in the top of this paper with your pencil.

16. If you are the first student to reach this point, call out loudly: "I am the leader in following directions."

17. Grasp your throat with both hands and open your mouth.

18. Underline all even numbers on the left side of this paper.

19. Say clearly: "I am nearly finished. I have followed directions."

20. Now that you have finished reading everything carefully, do only instructions #1 and #2.

Not only is this a terrific lesson

that children can have fun with and learn an invaluable lesson from, but it can be a great ice-breaker in an adult

radio class as well. Whether you're a classroom teacher or an evening instructor, remember that we all learn

better in a relaxed, non-threatening environment where it's okay to have fun while learning.

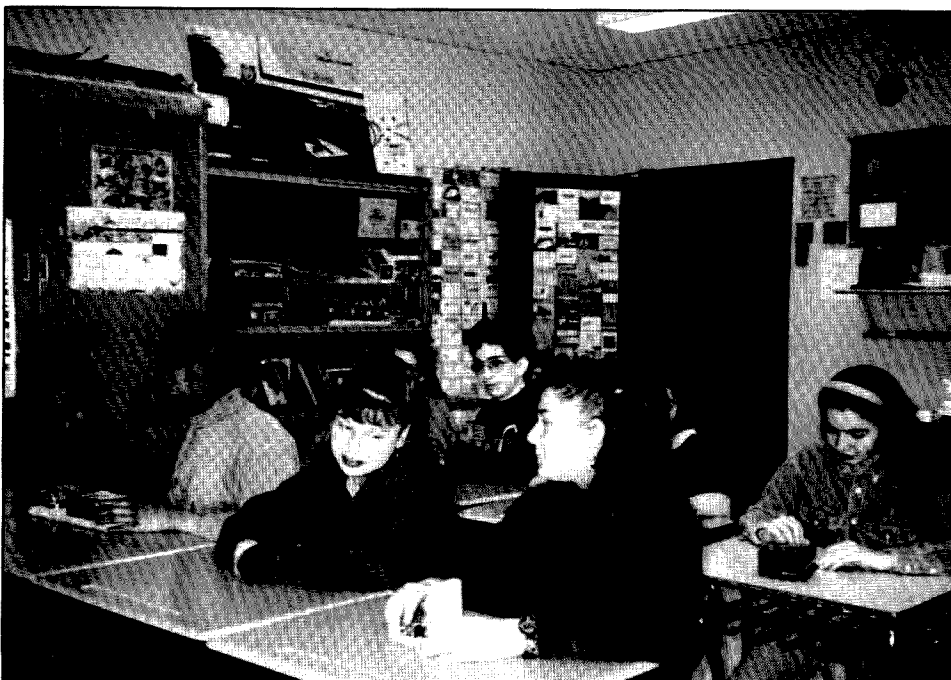


Photo B. The "buddy system" forces each child to listen to their neighbor.

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CIRCLE 223 ON READER SERVICE CARD

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Space restrictions for the March 1993 "QRP" column did not allow me to include the schematic for the controller. We'll take a look at the entire project this month.

Three of the four chips used in the controller are LM324 op amps. They're easy to come by and very inexpensive. Each LM324 consists of four op amps. The LM324 operates on a single power supply, a great advantage over the 741 op amp. If you build the circuit on pert board, notice the unusual location of the VCC pin (pin #4) and ground (pin #11) of this chip. Also, don't short the output of any of the amplifiers or you may damage the chip.

In the March column I described the array detect and power supply systems, as well as the state-of-charge reference source. This time around, we'll look at the FET driver and the driver switching. A quick look at the over-temperature comparator will wind up the tour.

From the voltage divider the battery sense is buffered by U1C. The output is then run to U1B where it is compared to the SOC reference voltage. Two 22 μ F

capacitors connected back-to-back slowly charge and discharge, depending on the input from the battery sense line. The output, on pin #8, will slowly rise and fall along with the battery's terminal voltage. The output of this amplifier, pin #8, is then routed to two more locations. First, it goes to U3B. This amplifier and U3D compare U3B's output and also act as LED drivers. Op amp U3 controls the function of the charging and charged LEDs.

The output of U1C also goes to U2D. Op amp U2D takes the output from U1C and the SOC reference voltage and will generate a string of pulses when the two voltages are alike. If either one of them changes, the output of U2D will also change. This is how the FETs are switched on and off—by the action of U2D.

The last op amp before the gate driver is U3C. This op amp acts like a switch to provide a nice square wave to the voltage pump. When its output is low, the voltage pump is turned on. This then turns on the FETs and they conduct, passing current from the array to the battery bank.

The voltage pump is nearly identical to the one that I mentioned in the first

part of this series. A 4001 CMOS chip will be used as an oscillator running about 300 kHz. The oscillator runs all the time and is never turned off. Gates C and D act as switches to couple the oscillator's energy into the voltage multiplier diodes. The output runs about +22 volts to the gates of the FETs. This is a bit over the maximum limit of the gates and therefore a 20-volt zener diode clamps the gate drive at +20 volts. This +20 volts turns on the FETs.

Although the FETs have a very low RDS (on), they can still generate heat when passing large amounts of current. The blocking diode will generate more heat at higher currents because of the 0.3-volt drop across it. A 10k thermistor monitors the temperature of the heat sink. U2C is a simple comparator checking the thermistor's voltage drop across the other 10k resistor. When the comparator switches states, the output on pin #8 goes high. This high is fed back to the input of the chip, providing a set hysteresis. This will

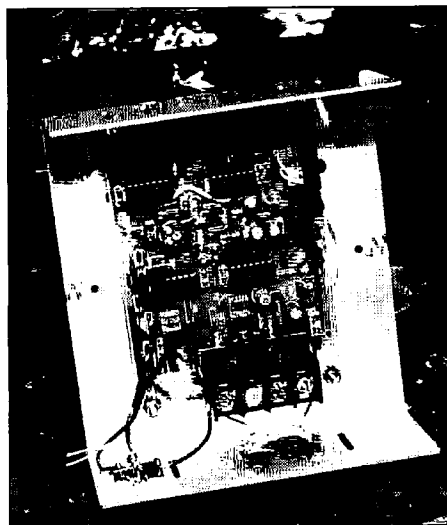


Photo A. Prototype for the controller.

keep the over-temperature shutdown from oscillating at the over-temperature point. The output also goes to the LED driver. When an over-temperature condition occurs, the "charging" LED will be forced off. Also, the SOC reference on pin #13 of U2D will be forced high, turning off U2D. Pin #8 of U3C then becomes high and turns off the voltage pump. The FETs are then turned off during an over-temperature condition. Everything will stay this way until the

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SPECIFICATIONS AND PRICES SUBJECT TO CHANGE.

Check the voltage on pin 1 of U2. It

Figure 2. PC board pattern and parts placement for the controller.

Next month I'll have some troubleshooting tips for the project and some modifications as well.

A Versatile NiCd Charger

Simple to build with off-the-shelf parts.

by Ivan T. Lorenzen W4JC

With the ready availability of all kinds of chargers, you may well wonder why anybody would bother to build one. One good reason is that by adding a few things (like a timer, a latching relay, a constant current regulator, and provision for adjusting both the charging and trickle rates) you will have a truly versatile NiCd charger. It will: (1) satisfy a wide range of current requirements; (2) automatically switch over to a trickle rate at the desired time; and (3) charge any number of cells, from one cell to 18 cells, with any mAh rating from 100 mAh to 1500 mAh. And it won't go back to charging again at the end of 24 hours.

There are probably as many philosophies regarding the best way to charge NiCds as there are people who use them. Some argue that constant voltage is best, others say constant current, and still others argue the merits of pulsed DC over filtered steady-state DC. It has also been argued that, in practice, one will work about as well as another, provided that limits are observed to prevent damage to the cell(s). I have used the constant current method for years and have gotten excellent cell longevity. The original 250 mAh pack in my early Tempo S1T handheld lasted for over 12 years and faithfully delivered its full capacity all that time, until it finally died of old age.

The usual practice has been to discharge the pack until the low-battery indicator comes on. On gear that has no low-battery indicator the NiCds are not put on charge until the terminal voltage is down to 1.0 volt per cell. Instead of the commonly used charging rate of 10% of the cell's rated capacity (0.1C), NiCd life can be extended if the charger is set at 0.08C and left on for 18 to 20 hours to achieve approximately 150% of the NiCd mAh rating (1.5C). At the end of the charging period the NiCds are put on a trickle charge set at one-half the charging rate, 0.04C. The NiCds can be left on 0.04C trickle charge continuously until they are to be used, and they will retain full charge until put into service.

The circuit of this charger contains nothing new and is quite simple. See Figure 2. All components are standard, off-the-shelf parts. The parts list includes Radio Shack

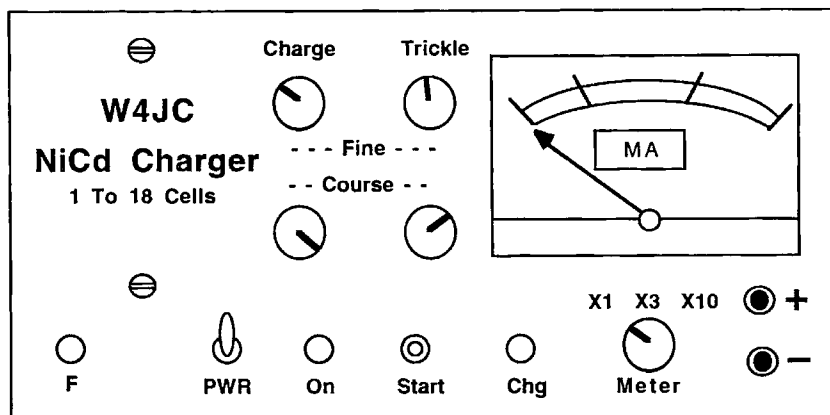


Figure 1. W4JC NiCd charger.

catalog numbers for some of the parts that may not be readily available elsewhere. The 100 ohm and 250 ohm potentiometers are available from Digikey (Telephone: 1-800-344-4539). Wiring is point-to-point, and the parts placement is not critical. Any box of adequate size to hold the parts may be used. The timer is a standard table-top type and sits alongside the charger. The polarized AC female socket supplying AC to the timer and the male polarized AC plug which plugs into the socket on the timer are from an AC extension cord, and polarities must be observed.

When SW1 is closed, AC is applied to the green pilot lamp, the timer clock, and T1. The relay is not yet energized, and its charger contacts connect the regulator output to the trickle adjustment potentiometers, so the desired trickle rate may be set immediately by adjusting R5/R6.

At this point, rotate the timer clock dial until its internal switch closes, sending AC to the "start" switch. Pushing the "start" switch lights the red pilot lamp and energizes the relay. One set of contacts holds the relay in its energized position. The other set of contacts switches the regulator output to the charge position, and the charging rate may be set by adjusting R2/R3. Since the regulator is connected as a constant current device, any number of NiCd cells from one to 18 may be con-

nected to the charger output terminals.

When the timer clock turns its internal switch to "off," both sets of relay contacts open, and the NiCds are switched to trickle charge at the rate previously set. The charge rate will not come on again unless the "start" switch is pushed.

This charger will do what you may now be using two or three chargers to do, and it will do it better.

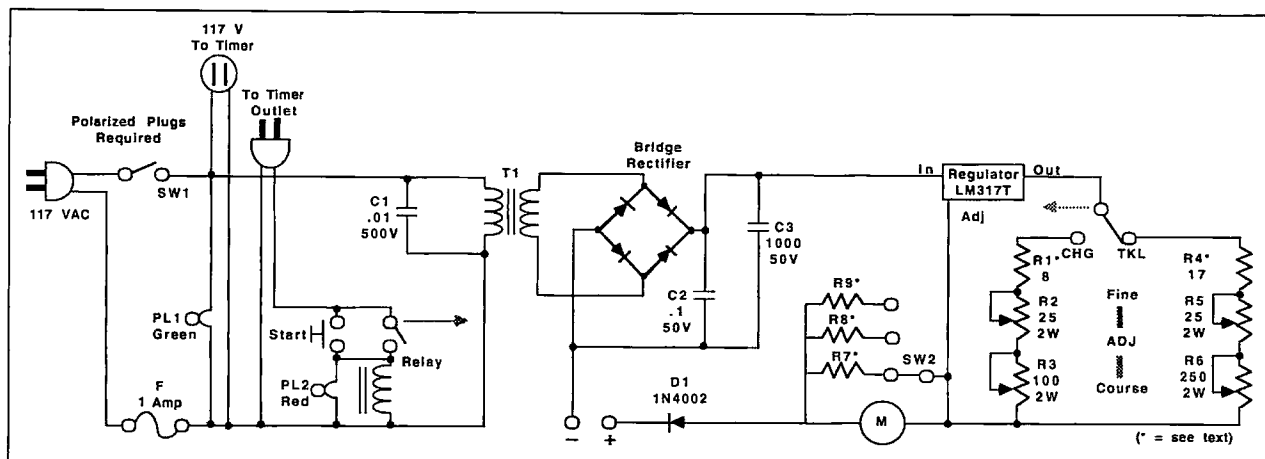
Construction

All parts are mounted on the panel. Remove the panel from the project box or case and temporarily position the parts to assure adequate clearance, before holes are marked and drilled.

The following parts are mounted on a 2" x 4" piece cut from unclad perf board: the relay socket, C2, C3, the bridge rectifier, and the LM317T in its heat sink. If a mounting angle bracket is not available, you can remove the center lug from a tie-point strip and bolt it to the perf board, then mount it on a meter bolt.

A tie-point strip, with one lug cut off, can be mounted on the other meter-mounting bolt and used for the junction of the meter-shunt resistors. A tie-point strip may also be fastened to one of the mounting bolts holding the transformer and used for the several connections in the AC part of the wiring.

The meter-shunt resistors are standard



sizes and will give readings on the meter within the accuracy of the average multi-meter.

A round file can be used to make three notches in the back of the plastic box for the AC cords.

Operating Notes

Always charge cells in series, not parallel, and be sure all cells have the same mAh rating. To put the charger into charge mode, rotate the timer dial until its internal switch clicks ON, then press the "start" switch. The charge rate is adjustable from 10 mA to 150 mA. The trickle rate is adjustable from 5 mA to 75 mA.

If even a short power drop occurs, charging will be stopped. When power returns, the cells will automatically be put on trickle. All you need to do is check that the trickle rate is set at 0.05C (32 mA for 650 mAh cells), and just leave the NiCds on trickle for at least 24 hours or until voltage per cell reaches 1.35 to 1.4 volts, measured with the cell(s) removed from the charger.

To avoid NiCd memory effects, always discharge NiCds down to 1 volt per cell before putting them on charge, and don't take the cells off charge until they have received a full charge.

If you want to check the trickle rate adjustment while the charger is in charge

mode, turn the power switch off momentarily. The red light will go out. Then turn the power switch back ON and adjust the trickle rate as desired. Press the "start" switch to return to charge mode.

Some NiCd battery packs have internal protective circuitry to limit charging current. In this case, the charger cannot be adjusted to force more current than the pack will allow.

Do not over-discharge a NiCd battery pack or you run the risk of polarity reversal in one or more cells. A safe discharge point is considered to be 1 volt per cell. If your equipment has a "Low Bat" indicator, don't try to get more out of it.

PARTS LIST

SW1	AC toggle switch	
SW2	Rotary switch, single-pole three-position, shorting type (make before break)	Radio Shack #275-1385 (All unused switch points are connected together and to the junction of R7, R8, R9 resistors.)
F	Fuse holder with 1 ampere fuse	
PL1	Green pilot lamp assembly, 120 VAC	RS#272-708
PL2	Red pilot lamp assembly, 120 VAC	RS#272-712
START	Momentary push switch, normally open	RS#275-1571
RLY	120 VAC relay, DPDT contacts, with socket	RS#275-217 and 275-220
T1	25.2V, 450 mA transformer	RS#273-1366
C1	0.01 μ F, 500V disc capacitor	
C2	0.1 μ F, 50V disc capacitor	
C3	1000 μ F, 50V electrolytic capacitor	
D1	Diode, 1N4002 or equivalent	
Regulator	LM317T with heat sink	RS#276-1778 and #276-1363
Bridge rect.	100 PIV, 1.5A	RS#276-1152
Meter	0-1 mA movement, marked 0-15	RS#270-1754 (Discard the external 15k resistor)
R1	Two 15 ohm, 1/2W resistors in parallel	
R2, R5	25 ohm, wirewound potentiometers, 2W	#271-265
R3	100 ohm, 2W potentiometer	Digikey #53C1101-ND
R4	Two 33 ohm 1/2W resistors in parallel	
R6	250 ohm, 2W potentiometer	Digikey #53C1251-ND
R7	6 ohms, consisting of one 10 ohm, one 15 ohm and one 220 ohm, each 1/2W, resistors in parallel (Meter scale X1, range: 0-15 mA.)	
R8	1.93 ohms, consisting of five 10 ohm and one 33 ohm, 1/2W resistors in parallel (Meter scale X3, range: 0-45 mA.)	
R9	0.57 ohms, consisting of two 0.47 ohm wirewound resistors in series and then connected across a 1 ohm and a 0.47 ohm resistor in series. (Meter scale X10, range: 0-150 mA.)	
1 pr.	Insulated binding post/banana jacks	
5	Small-diameter knobs for potentiometers and rotary switch	
2	6 ft. extension cords with polarized plugs, cut and connected as shown in diagram	
1	Project box or case of adequate size to accommodate all components—no smaller than RS#270-232 (approx. 8" x 5" x 2-1/2")	
2	Insulated tie-point strips RS#274-688	
1	Prepunched, unclad perf board RS#276-1394	
1	Adaptaplug cord and set of Adaptaplugs from a no-longer-used Radio Shack AC/DC adaptor/charger, such as #273-1652	
1	Pair of solderless banana plugs	

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

ATV Information Sources

The question I am most often asked is, "Where do I find out more about ATV?" Fortunately, there is a variety of publications, newsletters and books dedicated to amateur television. Another good information source is a catalog from one of the ATV manufacturers listed here. Just browsing through one of these catalogs should stir your imagination as you dream about your ideal ATV station.

ATV Publications

There are several publications that cater specifically to the ATV crowd (see the sidebar for address/order info):

ATV Quarterly. This magazine is dedicated to amateur television. It contains a large variety of ATV construction projects, reviews of the latest equipment and an activity news section.

CC-TV. This is the journal of the British Amateur Television Club and offers a wide selection of amateur television projects. Many of the articles deal with FM ATV or video accessories and are fascinating reading.

The Spec-Com Journal. Originally called *A5 Magazine* in the early '80s and before, this publication deals with specialized modes (including ATV). There are also sections about SSTV, packet, weather satellites and OSCAR satellites.

VHF Communications. Published in Europe, this magazine offers a number of VHF and UHF projects. Quite a few ATV articles appear as well. It is available in English (see the sidebar).

ATV Today! This is a newsletter that offers some construction articles as well as a news section showing some of the latest equipment available.

ATV Equipment Manufacturers

There is a wide array of companies

that carry products of particular interest to the ATV community. I've included a list of a number of these, along with a description of the ATV items they carry. You can now purchase a complete ATV station or build your own from the kits and accessories these manufacturers carry.

If you're fortunate enough to attend this year's Dayton Hamvention, you will find a number of these companies represented. There's no better way to decide which route to go than to actually observe the equipment in action at the Hamvention.

ATV Nets

There are two HF nets which meet weekly. If you live in the Midwest or on the East Coast, try listening to 3.871 MHz every Tuesday night at 9 p.m. local time (EDT). On the West Coast, there is a net every Sunday morning at 10 a.m. local time which meets on 7.243 MHz. These nets are an excellent way to meet the area ATVs, ask questions, set up skeds and generally stir up activity.

In addition, there are a number of local ATV nets which usually meet on the 2 meter band. For example, in Southern California there are nets which meet on Monday night at 7 p.m. (Mt. Wilson group) and Tuesday night at 8 p.m. (ATN). Both nets can be found on 146.43 MHz.

Calling Frequencies

The 2 meter band is usually used for establishing contact for an ATV QSO. Some groups use simplex, others use the local repeater. There are, however, a few frequencies that are commonly used for a specific region.

If you live in Southern California, try giving a call on 146.43 MHz; for the Midwest and portions of the East Coast, try 144.34 MHz (parts of Ohio use 147.45 MHz in addition to 144.34).

I hope this helps you to find other ATV activity. It only takes one other station to get things rolling!

ATV EQUIPMENT SOURCES

Advanced Electronic Applications, Inc. (AEA)
P.O. Box C2160
2006 196th St., S.W.
Lynnwood WA 98036
(206) 774-5554
(800) 432-8873 brochure info
Complete ATV transceiver (VSB-70) and accessories.

ATV World
3713 W. Charleston Ave.
Glendale AZ 85308
(800)-4-A-HAM-TV or (800) 424-2688
order line only
(602) 978-4348 tech line
Complete transceivers/down-converters and accessories.

Bestlink
130 Emmett Ave.
Madison TN 37115
(615) 868-4757
Complete ATV transceivers/down-converters—both AM and FM.

CCTV Corp. (GBC)
315 Hudson St.
New York NY 10013
(800) 221-2240
(212) 989-4433
(212) 463-9758 FAX
A complete line of miniature video cameras.

Comet Antennas
NCG Co.
1275 North Grove St.
Anaheim CA 92806
(714) 630-4541
(800) 962-2611
Antennas, omni-vertical gain and yagis.

Communications Concepts, Inc.
508 Millstone Dr.
Xenia OH 45385
(513) 426-8600
(513) 429-3811 FAX
ATV downconverter kits, power amps.

Down East Microwave
RR#1 Box 2310
Troy ME 04987
(207) 948-3741
(207) 948-5157 FAX
Antennas, transverters and pre-amps.

Electronics
12536 T.R. 77
Findlay OH 45840
(419) 422-8206
Video IDs, micro TV xmtr and other kits.

Engineering Consulting
583 Candlewood St.
Brea CA 92621
(714) 671-2009
(714) 255-9984 FAX
Computer ID system for the Commodore computer.

Hi-Spec
P.O. Box 387
Jupiter FL 33468
(407) 746-5031
Tube amplifiers for ATV; 33cm and up.

International Crystal Manufacturing Co., Inc.
P.O. Box 26330
701 W. Sheridan
Oklahoma City OK 73126-0330
(405) 236-3741
(405) 235-1904 FAX
VSB filter for ATV

Lindsay Specialty Products
50 Mary St.
Lindsay, Ontario K9V 4S7
Canada
(705) 324-2196
(705) 324-5474 FAX
Omni-horizontal ATV repeater antennas.

Micro Computer Concepts
7869 Rustic Wood Dr.
Dayton OH 45424
(513) 233-9675
ATV repeater controller.

Micro Video Products
1334 So. Shawnee Dr.
Santa Ana CA 92704
(800) 473-0538
(714) 957-9268
Miniature video cameras.

M2 Enterprises
7560 N. Del Mar Ave.
Fresno CA 93711
(209) 432-8873
(209) 432-3059 FAX
ATV antennas.

North Country Radio
Box 53-A
Wykagyl Station
New Rochelle NY 10804
(914) 235-6611
(914) 576-6051 FAX
ATV transmitter kits.

Olde Antenna Lab
4725 W. Quincy
Denver CO 80236
(303) 798-5926
Omni-directional wheel antennas.

Pauldon Associates
210 Ulica St.
Tonawanda NY 14150
(716) 692-5451
Amplifiers, pre-amps, etc for UHF and ATV.

P.C. Electronics
2522-WG Paxson Ln.
Arcadia, CA 91007
(818) 447-4565
Large selection of complete ATV transmitters/downconverters/transmitters, as well as modules, antennas and accessories.

R.P. Industries
1450 Jeffery St.
Ypsilanti MI 48198-6319
(313) 482-2670
Video overlay modules and telemetry computer systems.

Rutland Arrays
1703 Warren St.
New Cumberland PA 17070
(717) 774-5298 (7-10 p.m. EST)
FD22-ATV antenna.

Spectrum International, Inc.
P.O. Box 1084, Dept. S
Concord MA 01742
(508) 263-2145
(508) 263-7008 FAX
Transverters, antennas, passband and VSB filters, WX satellite systems.

WB0QCD Antenna Mfg.
770 Quincy Ave.
Clarence IA 52216-9368
(319) 452-3628
Alford slot antennas.

Wyman Research, Inc.
RR#1, Box 95
Waldron IN 46182
(317) 525-6452
Complete line of assembled ATV transceivers/transmitters/down-converters, including a line of FM video equipment.

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Model 440
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Model 146 160W 2 Meters 19db Gain .75db NF
Model 146OS 160W 2 Meters 19db Gain .75db NF
Model 440 70cm 100W 16db Gain .75db NF

All preamps have helical filters to prevent out of band intermodulation in the receiver. Model 146 covers the entire 2 meter band. Model 146OS is of very narrow bandwidth and would be suitable for SSB, Packet, or Satellite. Model 440 is factory tunable from 430-440 MHz or 440-450 MHz per customer request. All models are powered with 13 to 20 VDC and are mounted at the antenna.

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Wideband Test Amp and Antenna

This month I thought you would be interested in a simple project that can have multiple uses, namely the ability to observe wide ranges of frequency above 1 GHz with high gain and a low noise figure. Normally, wideband devices like a receiver or a test instrument such as a spectrum analyzer would be used, but they lack the proper sensitivity. The spectrum analyzer that I have is very good but it is 20-some years old and suffers from this same problem. It does have a large dynamic range of 80 to 90 dB, making it very useful. The problem is that its age and related noise figure must be in the 12-to-14 or greater dB range. A small improvement here would make a very big difference overall.

The problem is the same with most broadband receivers. The ICOM R-7000 is an excellent one. It is a super monitor receiver but you have to pay for all its well-thought-out options and excellent sensitivity. I would like to own one but until that day I will be putting things together (like this month's project) to compensate.

Try Surplus

This month's column assumes that you have some sort of broadband receiver or test set that is in need of a high gain, low noise preamplifier. Additionally, with this preamp an antenna is needed to cover the very large frequency band of operation to form the final part of the system. Let's start our

construction of a suitable amplifier by hunting in the surplus market to see if we need to construct from scratch or if we can put to use something that has already been built.

Building from scratch usually poses problems in acquiring component parts. In this case, there is a simple solution: Look in the surplus market for something that exists in quantity. This project, the preamp, is constructed out of a surplus satellite LNA (low noise amplifier). Normally, this amp is built for operation in the 3.7 GHz to 4.2 GHz range, with 30 to 40 dB gain and a low noise figure (something near 1 to 2 dB) for most surplus units I have observed.

Surplus availability is quite good—most people are upgrading their existing systems to lower noise figure amplifiers and smaller dishes. This relegates the older (higher noise figure) amps into the surplus market. The price on the surplus swap meet market is around \$5 as is, \$10 for stated "good" units. Of the several LNA amplifiers of various designs that have passed through my hands, only one had a blown front end stage. All the other LNA amplifiers worked. The defective one showed signs of corrosion and water leakage into the inside of the case. Let's hope you have the same luck with the LNAs that you find.

The application I have in mind for the LNA is not just to monitor the 3.7 to 4.2 GHz band. With a small modification, Kerry N6IZW was able to increase the frequency range of the amplifier to cover from 800 MHz to about 4.2 GHz, with associated gain in the 20 to 30 dB area over bandwidth. There were gain peaks and dips, but for the most part the gain curves looked good.

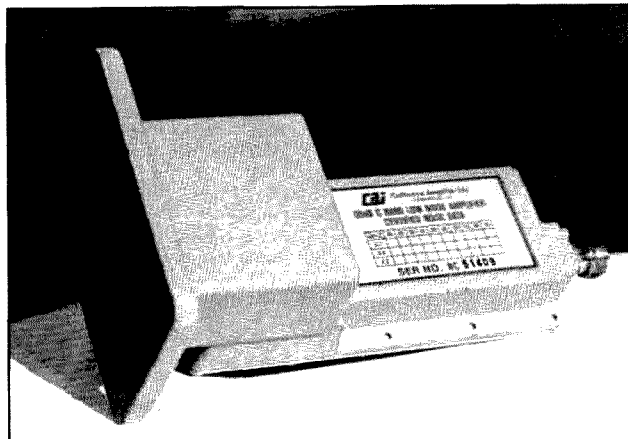


Photo A. Standard 3.7 to 4.2 GHz LNA.

Construction

The modification is somewhat delicate, but if you're careful it can be done easily. First, open up the LNA by removing the small screws which hold the amplifier cover onto the main aluminum cast body. Remove the cover and the PC board for the amplifier. Now the associated circuitry should be exposed. Looking at the amplifier RF circuits you can see several stubs on the input and output of each stage in the LNA. These stubs are used in the original design to peak up each stage for the best gain and noise figure in the frequency band of interest, namely 3.7 to 4.2 GHz. Using an X-acto knife, gently cut/disconnect these tuning lines (they are the thick lines) from the main transmission line that runs straight from the input to the output of each device. See Figure 1 for details.

Disconnect all such lines, being careful not to disconnect the narrow RFC lines which supply DC power and bias to the FET devices. Also, be careful to ground the work station to prevent static buildup from damaging the devices in the amplifier. When working with the X-acto knife, use a sharp blade and don't press hard on the soft Teflon PC board while disconnecting the tuning lines. Teflon is quite soft and you will go right through the board material if you're not careful. Use light pressure to cut away part of the connection to DC-isolate them. You don't have to remove the entire line, just disconnect it from the main line.

Removing these tuning stubs alters the frequency response of the amplifier gain curve. It will not be peaked up at its normal range but will now give a much broader and lower frequency range of operation. In the unit that Kerry modified, the device gave usable operation from 800 MHz to over 4 GHz.

Once that part of the operation is complete, the input circuit can be changed as we will not be using a waveguide for this amplifier anymore. The input probe in the waveguide cavity must be removed, and an isolation capacitor needs to be added to the circuit first. Locate the place where this probe is connected on the main PC board trace and cut this trace again

with the X-acto knife. On this spot we are going to place a 10 pF (or so) value coupling capacitor to give DC isolation to the input of the amp. In the unit's original condition this was not necessary because the probe was isolated in the waveguide. We will remove the waveguide and replace it with an SMA connector, which requires DC isolation. After the board has been cut to accept the capacitor (a chip type), stop this part of the procedure and unsolder the probe from the PC board, which is now isolated by the cut in the PC board. Remove the probe from the PC board connection.

Now, with a bandsaw remove the waveguide flange, cutting it flush with the top of the amplifier body. Put a piece of masking tape on the open side of the amplifier to keep metal filings from contaminating the PC board area when the waveguide flange is removed. You will also be able to remove the Teflon insulator that insulated the old RF waveguide probe. It should just pop out with a little pressure. Clean the PC board hole where the removed probe was soldered and in its place put an SMA coaxial connector.

The Teflon insulator on the connector might need a little trimming, but some are exactly the right size to slip in the hole where the old Teflon insulator used to be. The center connector of the SMA connector should be long enough to fit right in the PC board hole you just cleaned.

Mark the SMA connector mounting holes and drill and tap for a couple of mounting screws to hold the SMA connector body securely to ground. Now, on the PC board remove the paper tape from the PC board cover plate area and mount the new coupling capacitor to the SMA connector tip and to the other side of the center line you cut before. This will give you DC isolation to the coax connector.

At this point, check the unit for errors. When you are ready, reapply DC power. If you used standard static protection everything should be OK. Even so, amplifiers in circuits are less susceptible to static than loose components. If you used proper care in making the modification, everything should

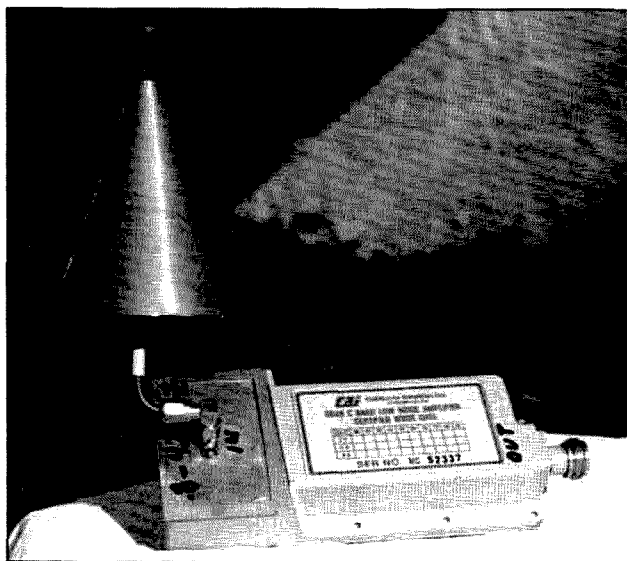


Photo B. Modified (cut housing) LNA.

be OK. Remember that different units might give varied results, but for \$5 or so, why not give it a try? You don't have much to lose.

Constructing an Appropriate Antenna

Due to the broad bandwidth of the modified amplifier, we needed to construct a new antenna for bench or even outside applications. The normal antennas we had did not cover such a wide range of frequencies. Our station monitor antenna, which works from 50 MHz to over 1200 MHz, worked well but something was needed for the upper frequency ranges. We decided to construct a simple small-scale version of our low frequency monitor antenna, a disccone for the 1 GHz to 4 GHz range. This antenna worked quite well over our frequency range and it is easy to duplicate.

A miniature replacement of the low frequency disccone turned out to be only 3-1/2" high and less than 3" wide at the base and top hat of the antenna. This antenna is basically a funnel turned upside-down, with the bottom spout of the funnel removed. At this point a top hat or disc is electrically connected to the center of the coax cable. In our case we used 0.141 o.d. 50 ohm hardline, quite common in microwave circuits.

The bottom part of the funnel, or ice cream cone, has the coax cable protruding just 3/32" above the small end of the cone (ground portion of the coax). The portion of the 3/32" is all insulator, separating the funnel cone from the top hat. The center conductor is about 1/4" longer, sticking up above this 3/32" of insulation. Mount the top

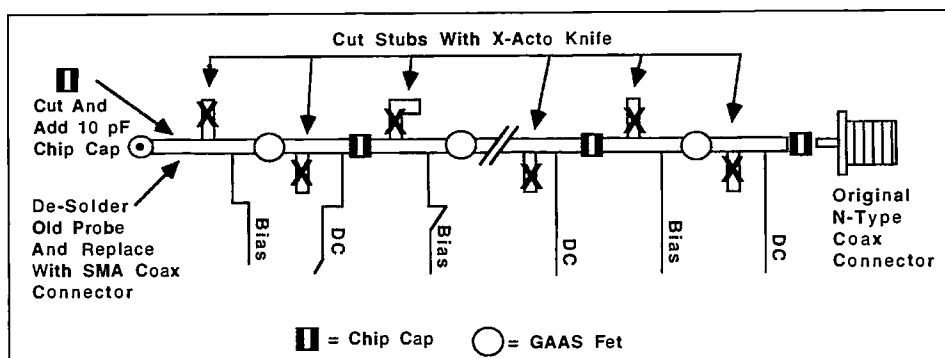


Figure 1. LNA disconnect stubs (example).

hat horizontally to this center conductor, to the top of the cone, and solder it directly to the center of the coax cable. The 3/32" space of insulation serves as an isolator between the top ring and the bottom cone. See Figure 2 for information on the disccone dimensions.

Please note that the dimensions of the disccone antenna are not too critical and there is room for error. Our antenna was cut out of flashing copper about 0.020" thick, and it bends (forms) quite easily. It also solders with small-wattage irons. Most of the 0.141 solid sheath coax comes with Teflon insulation, making it somewhat impervious to heat during construction.

In actual use, the antenna and amplifier functioned well, although no actual measurements were made on antenna parameters. The antenna and amp have been used in spectrum analyzer applications to observe low-level products from workbench construction projects. They can even detect some

of the microwave ovens in the neighborhood. Their operation is on the low 2.2 GHz part of the spectrum. In any case, this conversion should give you increased sensitivity over quite a range of frequency, with lots of gain and a great noise figure, for a little effort and few dollars.

Be sure to keep a good stock of X-acto knives and blades available for conversions on lots of surplus items. After all, who said you can't make a silk purse out of a sow's ear?

Mailbox

The Tin Can filters for 2 meters in the November and December 1992 editions of this column caught Dick N6ISY's eye. He is quite involved with the C.A.R.E.S (Coastal Amateur Radio Emergency Services) group. They use 2 meters for primary communication and have found that when two nets were being run on 2 meters there were desense communication problems.

Their problem is related to the operation of many different types of 2 meter HTs, all operating in close proximity to each other on different frequencies, causing desense to each other.

Since most of today's newer radios are quite compact and capable of operation on wide bands of frequency, this type of problem is common. Some form of frequency limiting is necessary to prevent the excellent front ends from being overloaded or saturated from nearby RF. Quite a few of my HTs suffer in varying degrees from this problem, even from commercial radio and TV frequencies when their transmitters are nearby. The problem is due to the wideband "hypersensitive" front ends that are not tuned to a specific frequency. In this case a filter would help solve the problem.

The cavity or "soup can" cavity can be placed on your antenna lead to provide the required isolation from other frequencies. The narrow passband of the cavity will provide attenuation to the other frequencies, providing the extra margin for operation. We found that the bandwidth of the Tin Can filter was quite narrow, somewhere in the 100 to 200 kHz range on 2 meters (for typical Tin Can cavities). This is dependent on the can size, construction details and coupling link placement. All this can be "jiggled" or adjusted to allow custom design after your first-cut design attempt. There are so many factors involved, however, that most work out well with some re-positioning or different can selection. You just have to try for yourself—all you have to lose is a little time and very few materials.

With small ceramic variable capacitors suitable for low power HTs, running 5 watts would be OK. As always, try out this type of filter with even lower power (100 mW on some HTs) when testing so you don't damage the HT you are using. If pre-tests can be done with something other than a rig, so much the better. I happen to be blessed with a well-stocked workbench, allowing most types of measurements to be made with test instrumentation. It proves to be very valuable to see what exactly is going on. However, lots of small projects can be constructed with a little care and no special test equipment other than an SWR meter.

The Tin Can filter is just a compact

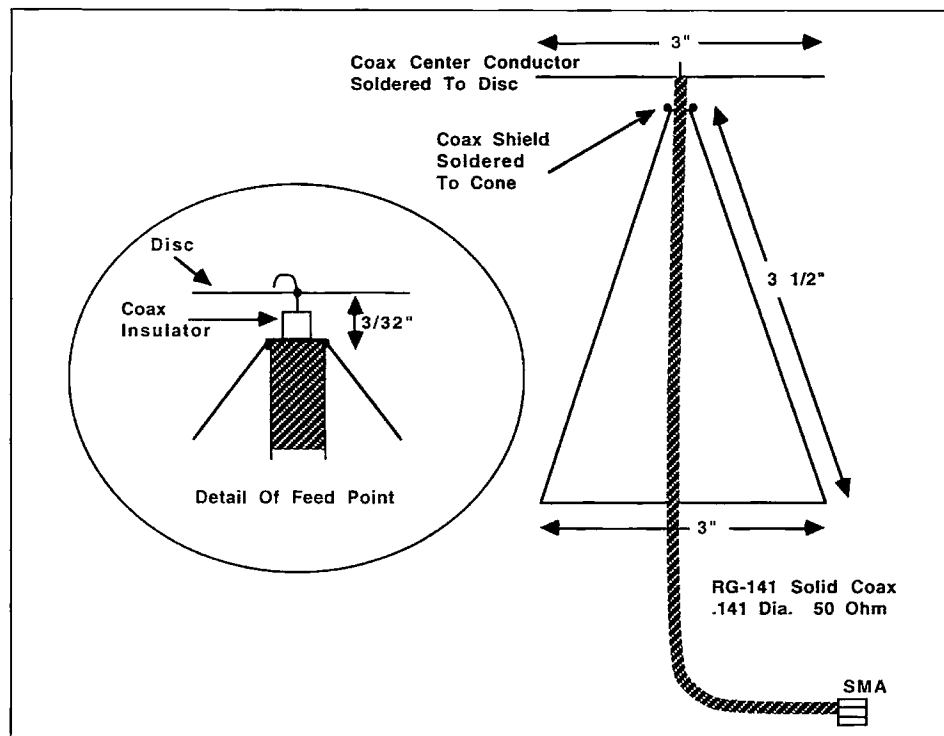


Figure 2. Disccone antenna 800 MHz to 4 GHz.

cavity-high "Q" filler that can be cheaply constructed. It's sort of a poor man's cavity, and it should not cost more than a couple of bucks to construct. All that is needed is two BNC connectors, a tin can, a small ceramic 10 pF capacitor, and a short section of 3/8" to 1/4" hoby brass tube for the center element. Don't worry about the input/output links being a direct short; they are at DC but at 145 MHz they represent something in the order of 50 ohms reactance. At RF this is not a short!

A variation of the cavity is the multi-tuned circuit I covered earlier. There has been some discussion as to coupling loss for different construction types. In the case of high loss, the problem lies in poor circuit-to-circuit coupling between coils. One cure is to place a coupling link in place from one circuit to the other. This is nothing more than a short piece of large diameter insulated wire soldered to the variable capacitor on one circuit and bent near the other circuit. Try several places for positioning; test to improve coupling loss. It's a cut-and-try proposition at best but will make a difference.

As always, I will answer questions on this and related projects. For a prompt reply please send an S.A.S.E.

10 GHz EME Activity

On January 31, 1993, at 22:30, G3WDG and G4KGC made two EME

QSOs on 10 GHz. This is believed to be the first made on this band from the UK. The initial QSO was with WA7CJO in Phoenix, Arizona, at 22:30. This was the second attempt. The first test on January 30 was partially successful as WA7CJO was heard at good signal strength but they could not find G3WDG's signal. This difficulty was caused by a problem in a preamp at WA7CJO's location.

The antenna in use in the UK was a 10-foot solid dish (Andrew 11 GHz version) mounted on an EL/AZ mount originally intended for satellite TV use but modified for a motor drive. The dish was scraped off from a local electronics company where G3WDG used to work. The rest of the equipment consisted of a Hughes 28 watt TWT amplifier. Many thanks to WA5VJB and KY7B for their help in acquiring this tube and refurbishing the power supply.

This is typical of some of the contacts that, with dedication and planning, can be made. I will have more detailed information about this contact and others in my next column. Congratulations for a great job done.

Update

The West Coast VHF-UHF Conference in Ventura, California, is May 21-23, not May 12-14th as originally reported and the ARRL book is \$10 at the conference, \$12 afterwards.

RANDOM OUTPUT

Continued from page 88

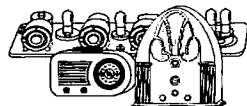
intelligence. (Personal note to Mike Galego KA4MUJ: The word frequency is pronounced "free-kwen-see," not "free-ken-see." There's a "w" sound in there.)

Other than giving yours truly the chance to poke fun at these misfits, what does all of this mean? It means that the FCC is finally doing what the amateur radio community has been asking them to do for years: Clean up the mess on our bands. The rest of us are sick and tired of having our frequencies overrun by vermin. We do not care which side of the issue they are on. We want the outlaws rounded up. In fact, it doesn't have to take that long or cost that much money. If the FCC made a concerted effort, dedicating their monitoring stations to policing the ham bands for four random weeks out of the year, I bet our bands would be a lot less messy and the FCC would collect a lot more money. Once they round up all the ne'er-do-wells on 20 meters, they could spend a few nights monitoring 80 meters.

The other thing that needs to happen is we must come up with a way that repeat offenders like Dick Whiten can have their licenses yanked for good. It would be very easy to write something into Part 97 like "the FCC shall have the au-

thority to revoke the license of any amateur radio operator upon receipt of that amateur radio operator's third Notice of Apparent Liability, and that person shall no longer be eligible to receive an amateur radio license." This isn't exactly strict "legalese," but you all get the point. An amateur radio license is a privilege, not a right, and those who abuse the privilege should be banned for life. If you don't play by the rules, you can't play. Period. End of story. Maybe I ought to seriously consider writing up a rule like this and asking the FCC to consider it, all formal and legal-like. What do you think? Would you support something like this? If I hear from enough of you, I'll do it.

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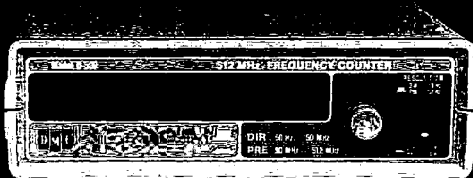
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Arnie Johnson N1BAC
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Notes from FN42

When it rains, it pours! There was much news in the mail for this month! Some of it will have to wait 'til next month.

It's a small world, again! I went to Boston to have lunch with one of my sons last week, and he introduced me to a young lady who was moving into the building he lives in. She was being helped by two Chinese men and one woman. He told me later that she was from Beijing, China, so of course I asked her if she knew anything about Tsinghua University. She said "no" but the other girl she had introduced me to earlier had graduated with a chemical engineering degree from there. I wish I had known that earlier so that I could have found out if she knows Rick Hunter, our Ambassador for China, who is a student there.

One last thing before all the news. It's that time of year again: the semi-annual pilgrimage to HOSS-TRADERS. The location of the best out-of-doors ham flea market in the Northeast, maybe even in the world,

has been moved from its old location in Deerfield, New Hampshire, to the Rochester Fairground in Rochester, New Hampshire. The primary date is Saturday, May 8th, but the gates will open on Friday, May 7th, at noon. VE testing facilities will be available. All proceeds above expenses go to the Shrine Hospital in Boston. The autumn date is October 16. For more information contact K1ROG @ K1ROG. ME USA.NA on packet.

Look for me at Hossstraders. I'll be the one running around looking for bargains, with no money in his pocket, but having a great time! 73, Arnie N1BAC.

Roundup

Europe Downloaded from packet: Hello Clover users. I have just received a message from Fred DK4ZC saying that many EU hams would like to QSO in Clover with USA hams in order to test their setups and just to have somebody to talk to in this new mode. According to Fred, most of them operate and monitor 21.083, 21.084, 14.083, and 14.084 kHz. Let's give them a hand. Ramon KP4GE @ KP4GE.

Montserrat Letter from Stu

Stephens K8SJ: As reported in the January 1993 issue, I was active from Montserrat in the British West Indies from February 5-17, 1993. My QSO totals were 3,071 CW and 2 SSB, over one-third of those on 40 meters. I contacted 81 countries, all continents, but no JAs (I didn't even hear any).

The equipment was an FT-767GX, 100 watts to an Inverted V at 30 feet. A venerable crystal-controlled DX-20, 35 watts, did 30 QSOs when the FT-767GX fan acted up briefly. Semi-casual operating style (negotiated with the XYL and two young harmonics) was about one hour in the morning, one hour in the afternoon, and three hours late at night.

Special apologies to those I worked on February 16-17 QLF style (sending with my left foot). My arm literally blew out on me. I never knew how strenuous operating a key paddle is in the long haul! I had to relearn how to send with a different finger combination to replace the blown neurons in my thumb and arm! Next time, a memory keyer!

QSL to K8SJ, 1992 or 1993 Call-book address: P.O. Box 266, Girard OH 44420. Foreign hams may QSL through the USA/ARRL Bureau, "VP2MFA c/o K8SJ." Non-SASEs will be routed through the Bureaus.

The Montserrat Tourist Board and Montserrat Amateur Radio Society are very interested in encouraging ham ac-

tivity and visitation of the island. We had a wonderful time with the people the beaches, and the mountains o Montserrat, "The Way the Caribbear Used To Be." It is an extraordinarily beautiful, safe, and peaceful place. The cost of a Montserrat vacation is comparable to a Florida resort stay: Travel costs are a bit higher, but living expenses and accommodations can be quite reasonable on the island. Our total expenses for two weeks were the equivalent of a week at Disney World. And VP2M has better pile-ups than W4!

For further information about Montserrat, write to: Montserrat Tourist Board, P.O. Box 7, Plymouth, Montserrat, West Indies; or Montserrat Amateur Radio Society, P.O. Box 448, Plymouth, Montserrat, West Indies. The ARRL, 225 Main St., Newington CT 06111 has reciprocal licensing info and applications. 73, Stu VP2MFA/K8SJ.

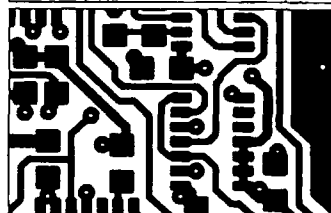
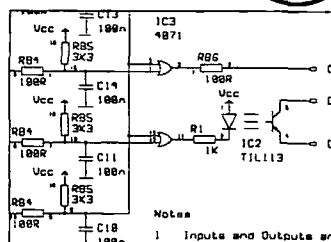
Russia Downloaded from amsat.org, forwarded from SED-SNEWS: The Russian solar sail Znamya experiment ended Sunday, February 7th, when the sail entered the atmosphere. Current reports indicate that initial results went well after it was deployed from the Progress TM-15 cargo craft at the MIR space station about 0400 UTC February 4th. The solar sail illuminated several areas in Europe, especially in Toulouse, France. Apparently in that southern

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French city, near the Spanish border, the streets were noticeably brighter during the pass, as seen by several town people.

Shortly after it crossed the day/night terminator in Europe, the solar sail was released from the Progress. The sail then lost altitude until it re-entered the atmosphere on the 7th.

Certainly this ranks as one of the more noticed Russian/CIS space experiments in recent years. (Glenn Chapman, Simon Fraser U., glenn@cs.sfu.ca).

Letter from Dmitri A. Soudov: After having gotten familiar with the November '91 issue of 73 (occasionally received from my American pen pal) there appears to be a strong feeling of nostalgia for my former military specialty as I read about more and more things and problems familiar to me. I was a radio operator during my two-year military service, working as a CW communications operator and receiving high-speed air notification information (also in the CW mode). However, after being demobilized in 1988, I didn't have any opportunity to become a licensed civil amateur, first of all because of having no chance to get proper gear in my country. So, I still remain a SW DXer, my main interest being broadcast stations, but not giving up hope to start again that fascinating hobby of radio communication.

At present I am in contact with several US amateurs who are also interested in the DXing of broadcast stations, and who know about the problem of DXing the stations in CIS broadcasting in the Russian language. Many stations don't send QSLs if the report is written in a language other than Russian. So, I'd like to offer a solution to this problem.

If any of the 73 readers would like to send their reception report to a station on the territory of the former Soviet Union, broadcasting in Russian, but don't know the language, then send your report in English to me. I'll make a qualified translation and forward it to the station you need in the CIS. US\$2 or 4 IRCs fee, please. For an additional US\$2 fee I could keep correspondence with the station by myself and then send you the reply translated into English. This price just covers leasing computer time to compile the reports, and the greatly increased postal tariffs in Russia.

Please send your requests to Dmitri A. Soudov, P.O. Box 96, Kazan-80, 420080 Russia.

Ukraine Downloaded from packet from Lisa KD6BLK: Thanks to my new packet pal in Russia I have the following information to share: Vic, UB5WPR, can receive packet messages addressed to UB5WPR @ U5WFLV.UKR.EU. He loves to hear from people, so if you want to explore packet DX send him a message.

The Ukrainian Amateur Radio League (UARL) informs us that since January 1992 the Central Radio Club of Russia (P.O. Box 88, Moscow) has been demanding additional payment

(except postage) for QSL cards addressed to the Ukrainian radio amateurs. Nobody understands why. So, please DO NOT send any QSLs for the Ukraine via P.O. Box 88, Moscow. Use only the UARL QSL Bureau address: P.O. Box 56, Kiev, 252001, Ukraine.

The Second Conference of the UARL was held on January 30-31, 1993, in Kiev at which the following were elected as officers of UARL: President—Nick Gostry UB5UT; 1st VP—Anatoly Kucherenko UT5HP; VP—George Chiljanc UY5XE, and VP—Serge Bunin UB5UN.

Neuger, 286 Chandler St., Duxbury MA 02332, or via packet: WU1B @ NS1N.MA.USA.NA.

AUSTRALIA

David Horstall VK2KFU

P.O. Box 257

Wahroonga NSW 2076

Australia

The details of the long-awaited changes to the licence structure in Australia were announced at the SEANET '93 convention, held in Darwin on August 31, 1992, and was relayed via phone patch to the various WIA Divisions for a live broadcast.

“... the 70 cm frequency allocation for UK Novice licensees has just been expanded to 432.0-440.0 MHz, i.e., it will now include the satellite subband for the first time.”

For any questions please contact the UARL at: P.O. Box 57, Kiev, 25001, Ukraine, or telephone (044) 446-22-39, Fax: (044) 488-39-68, or packet UB5UT @ UT4UX.KIV. UKR.EU.

United Kingdom Downloaded from amsat.org: UK Novices on OSCAR This week's GB2RS News Bulletin reports that the 70 cm frequency allocation for UK Novice licensees has just been expanded to 432.0-440.0 MHz, i.e., it will now include the satellite subband for the first time. UK Novices will thus be able to access any satellite with a 70 cm uplink, including AO-10 and AO-13.

Of course, the Novice power limit of 3 watts output will pose a challenge, but one that can be overcome. With 3W output, forward gain of 17 dBi (typical of a 40-element cross-yagi—20 elements each way) will produce up to 150W eirp, more than enough to access AO-10 or AO-13 if conditions are good.

UK Novices have call signs with 2*0 and 2*1 prefixes and three-letter suffixes, where * is a geographical indicator (E = England, M = Scotland, W = Wales, I = Northern Ireland, D = Isle of Man, etc.). For example, 2E0AAA would be a Novice in England, while 2D1AAB would be located on the Isle of Man. A “0” in the call sign indicates that the holder has passed a code test and enjoys limited HF privileges; “1” is no-code.

Who will be the first UK Novice to make an OSCAR QSO, and who'll be the first to work one? Sorry, 2E0 won't count as a new country. 73, Ray Soifer (71331.1337@CompuServe.COM)

USA/Guatemala Request from Paul Neuger WU1B via packet: My daughter Lisa N1IAR is considering going to Quetzaltenango, Guatemala, to attend the Casa de Espanol Xelaju Spanish School. I know nothing about Guatemala, the school, or how to get a license for Guatemala. I would certainly appreciate any information you can pass one to me. Address: Paul

a no-code Limited Novice licence allowing voice and packet radio on 2m and 70 cm; “Limited” licences (no HF privileges) may use FM (voice) on the 10m band to encourage its use (and presumably to keep the pirates out of it); amateurs holding both Novice and Limited certificates will come under an Intermediate category of licence; Novices will be permitted higher power outputs, to be consistent with commercially available equipment; and various restrictive rules applying to both voice repeaters and packet radio will be relaxed, permitting greater freedom for experimentation, etc.

All In all, it appears that these changes will encourage many more people, especially computer “whizz-kids” to take up amateur radio. I acknowledge the Wireless Institute of Australia (WIA) as the source of this information.

The WIA has had charge of the amateur examinations for over a year now, with a team of more than 400 registered examiners. It does not appear to be the debacle that its opponents had predicted, but as usual, there are some bad apples. It appears that four examiner teams are under investigation by the DoTC for apparent irregularities in the conduct of examinations. Cheers for now. Those with access to Internet can contact me as “dave@esi.COM.AU” or packet “VK2KFU @ VK2RWI.NSW.AUS.OC.”

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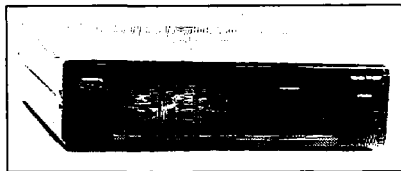
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73 Amateur Radio Today • May, 1993 77

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AEA

AEA has introduced its newest multimode data controller, the PK-900. The PK-900 boasts a powerful triple processor system and provides all standard amateur digital modes, dual simultaneous ports, a PACTOR option, a large back-lit LCD display, a 9600 bps G3RUH/K9NG plug-in

option board, a Direct Digital Synthesis AFSK tone generator, six selectable receive modem tone pairs (from 170 Hz to 1000 Hz), packet and AMTOR maildrop, 16 gray shade WEFAX (with optional software) and much more.

The suggested list price is \$549. For a product data sheet and a list of authorized dealers, contact *Advanced Electronic Applications, Inc., P.O. Box C2160/2006 196th St. SW, Lynnwood WA 98036; (800) 432-8873, (206) 774-5554. Or circle Reader Service No. 201.*

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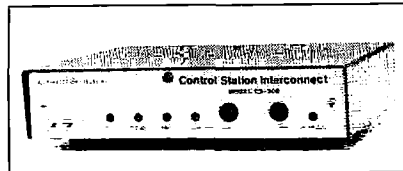
The DSP-59 noise filter from Time-wave Technology Inc. reduces and filters noise and interference to improve radio reception, reducing QRM and QRN on speech, RTTY and CW signals. It uses digital signal processing technology to provide optimum filters for five basic functions: random noise reduction, tone noise reduction, high-

pass filtering, low-pass filtering, and bandpass filtering. The five functions are combined to make five switch-selectable modes.

For prices and more information, contact *Timewave Technology Inc., 2401 Pilot Knob Road, St. Paul MN 55120; (612) 452-5939, Fax: (612) 452-4571. Or circle Reader Service No. 204.*

CONNECT SYSTEMS INC.

The new CS-900 from Connect Systems Inc. is the first low cost VOX (voice-activated) simplex phone patch to incorporate powerful standard features such as a half-second Electronic Voice Delay (EVD), a built-in programming keyboard with digital display, a 90-memory speed-dialer, last number redial, call progress tone detection, a user-programmable CW ID, and more. The CS-900 is totally VOX operated and does not use sampling. There are no sampling noises or interruptions—just smooth natural audio. The built-in EVD completely prevents



syllable and word clipping caused by slow switching transceivers. It will interface with virtually any transceiver. The only connections required are to the mike and speaker jacks.

For the price and more information, contact *Connect Systems Inc., 2064 Eastman Ave. #113, Ventura CA 93003; (805) 642-7184, Fax: (805) 642-7271. Or circle Reader Service No. 202.*

CM TECHNOLOGIES

CM Technologies has introduced a new packet radio software program for the Macintosh called *Savant*. Building on their previous success with *Virtuoso*, they have added a number of useful new features that make AX.25 packet operation on the Mac fast, easy and flexible. *Savant* offers a true Macintosh user interface, including scroll bars in session windows; an edit menu with undo, cut, copy and paste commands; and saving and printing of all or part of any session window. It also has a split window interface with both panes re-

sizeable. Animated icons and text fields in the session windows report the status of the connection: number of packets sent and outstanding, signal round-trip time, and number of retries. Multiple simultaneous connections are supported, each having its own window. *Virtuoso* has full-function digipeating capability and the option to assign an "alias" to your callsign.

For the price and more information, contact *CM Technologies, RR1 Box 83A, Kelley IA 50134; (515) 597-2051, CompuServe: 71574,421. Or circle Reader Service No. 203.*

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Continued from page 4

really comfortable with the government treating you like a slave and telling you what you have to do.

If The Schools Are So Bad, What Can Be Done?

I've covered my recommendations for a totally new kind of educational system in my book, *Declare War*, so I won't go into the gory details here. Briefly, I recommend school be made non-compulsory; that tests and grades be eliminated; teachers be replaced by team leaders; schools be open year around; ed schools be closed; teacher certification ended; radio, computer and other high-tech clubs be encouraged; and so on. Probably nothing you'd be interested in.

If you do want to learn more about education you can access a list of the books I've read on the subject on the 73 BBS (603-924-9343).

My, How Things Have Changed! And Not for the Better!

Us old-timers have noticed the way "the world has changed." More crime, drugs, riots, poverty, divorce, homelessness, and porno. Family life is less like the Nelsons and more like the Simpsons these days.

You don't suppose there could be any connection between all this and our educational system, do you? Isn't what we're seeing happening exactly what you'd expect from the education John Gatto was forced to provide? And which he got awards for providing?

But, other than sit around and wring our hands, what can we do about it? The educational establishment has our hands tied. Let's say that you're the one parent in a hundred (or thousand) who actually takes a look at the stupid books your kids are using for texts and you get angry enough to want to at least get the kids better books from which to learn. You'll soon find out what you're up against.

The books are selected by the local school board. You talk with them and find they know little about the books. They just use the recommended book list. So why not run for the school board so you can start changing things?

Two years later you've made it. Then you find that getting better books onto the list, even if there are any, is a multi-year project. It seems that the state textbook commission reviews the books for any specific course once every five years. And here you'll find yourself up against a well-healed sales force from the bigger publishers.

You're up against institutionalized mediocrity. The books are lousy. Many teachers are bad. The classrooms and bells are bad. The curriculum stinks. Our educational system doesn't need a patch job, it needs re-inventing. Patching will be fought at every level by the entrenched system . . . teachers, administrators, unions, textbook

publishers, school boards, and a host of government agencies dependent on the status quo.

Is the situation really hopeless? They got us when we were kids and did us in. They're doing the same thing to our children and grandchildren. Is there no way to stop this institutionalized massacre of our kids minds? Not unless you get mad enough to break through the wall of apathy the system has built for you. Not unless you really want something better for your children and your country.

A good educational system can make all the difference. It can end poverty. It's the *only* way to end poverty. Just taking money away from those who worked hard for it and giving it to those who haven't bothered to get an education because the system defeated them isn't a good answer. We've tried that and it hasn't worked.

A good educational system will cost much less than the bloated bureaucracy we have now. It'll prepare our kids to be competitive in the 21st century with the other industrial nations. It'll give them a happier, better quality of life. It'll bring back inventiveness and creativity. It'll greatly reduce crime and drug dependency. It'll end welfare, cut down on teenage suicide, reduce divorces, improve our health, and perhaps even get us interested enough in government so we'll end the corruption in Washington.

None of this is going to happen with the school system we have now. These miseries are artifacts of the system. If people paid a fraction of the attention to fixing our educational system that they do to ball games, we'd be richer, happier, and healthier. Can it happen? You tell me.

Basis & Purpose Circa 1994

The original basis and purpose for the amateur radio service, as set out in 97.1, and enacted by Congress almost 60 years ago, back in 1934, is so totally out of date that it's about time for the Commission to consider rewriting our charter. A lot of water has gone over the bridge since then.

One of the basic reasons for allocating big gobs of the radio spectrum for amateurs was so that in case of war we'd be able to provide a pool of trained Morse code skilled operators, plus technically skilled personnel to maintain communications equipment. These reasons bore splendid fruit when WWII came along and 80% of our licensed amateurs went to war. I was one of the technicians, so I can attest to the validity of this purpose.

Further, the government bought our receivers from us for war use, so we provided an extra benefit. My Hallcrafters SX-24 was sent to Brazil to help provide communications for the government's Rubber Development Corporation, a project to try and grow rubber trees in the Amazon River area to make up for our loss of rubber from Malaysia, after it had been taken over by the Japanese. I wonder whatever happened to that wartime project . . . I've never seen it written up anywhere.

My old SX-24 may still be sitting somewhere in the Amazon rain forest in an abandoned building.

Another stated purpose for our "service" was for us to help pioneer new communications modes and technologies. Plus, we were supposed to provide emergency communications to help build international friendships.

My, how things have changed in only 60 years! The military has as much use for CW today as smoke signals. And modern equipment servicing is done by exchanging modules, not by electronic technicians and test equipment. Military equipment is so specialized today that 99.9% of us would be unable to help fix it. Heck, what percentage of today's hams can fix their own digitally synthesized transceivers? The military have no further use for hams, even if we were young enough to be of interest to them.

We've seen the whole concept of war change. When WWII came along we had a year or so to train people and build equipment. Now we have 100-hour wars. The military don't even need our frequencies any more . . . and they're sure not going to have much use for our ham rigs. None of these things happened during the Korean or Vietnam wars, and we have no prospect of them happening in any future conflicts we can envision. Modern military communications equipment is just too specialized.

If we're going to bring the Basis & Purpose up-to-date we need to rewrite it to fit our 1993 world.

We might start out with 97.1a, stating that the number one purpose of amateur radio is to provide entertainment for a group of largely retired middle-income older white men. A second purpose is to provide entertainment for the mentally deranged, thus keeping them from committing more heinous crimes. Better they enjoy spewing filth on 14.313, jamming traffic and emergency nets, creating pile-ups to the disgust of foreign operators, and venting their spleens over our repeaters, than molesting little girls . . . or young boys, as one of our best known pioneer repeater chaps did. Oh yes, I seem to remember a convention chairman who got caught at this too.

About the only original purpose we're still hanging in there on is emergency communications. But we're being squeezed hard on this by CB, cellular phones and other new technologies. If our emergency systems aren't capable of tying CB, our ham repeaters, cellular phones, police, fire and other emergency services together, we're not going to be needed for long. We need to clean up our act in this respect. Any volunteers to write articles to help our ham clubs get up-to-date in emergency communications?

We're so far behind in technology these days that it's unlikely we'll ever be able to do much pioneering again. We certainly did do a fine job a generation back, with our pioneering of FM, NBFM, RTTY, SSB, SSTV, meteor

scatter and moonbounce communications, and repeaters. Then, 30 years ago, we dropped the ball.

A New Manifesto

My own agenda is to make our priority the attracting of new, young hams to the hobby as a way to help our country generate the high-tech work force which is going to be needed if we're going to maintain a good quality of life. If we can do that we'd be well worth the investment in the spectrum allocated to us.

If we can generate a hundred thousand school radio clubs with an average of 25 members per club, we'll have the work force we need to invent, build, sell and service the technology of the 21st century.

Next, we need to update our emergency communications systems. I'd like to keep that as one of our purposes. But none of this CW traffic net baloney. Any system which can't handle at least 9600 baud won't be of much value. This means we need to get busy developing effective HF packet systems which will give us the throughput we need. We're doing fine on the VHF's, but we still need to be able to get the traffic dependably through QRM, QRN, QSB, and so on. In my past editorials I've shown how we can establish a communication protocol which will enable us to automatically translate our messages into any language in the world and have a throughput of 25,000 words per minute.

I like the concept of building international friendships, but that's completely incompatible with the ARRL DXCC Honor Roll, so one or the other will have to go. Maybe we can get the League to curb some of their endless contests too. These are not international friendship builders.

Please let me know what you suggest in the way of a new Basis and Purpose for 97.1.

Tackling the Deficit

Let's say that you buy a house and find an old painting in the attic. You take it down to a local antique shop and they give you \$100 for it. Wow! Then you read in the paper that the store has sold it for \$7 million. Would you be upset? Remember, you got what you thought was a good price for it.

Well, there's this 1872 law on the books saying Uncle Sam has to sell land for \$2.50 an acre. One parcel of 17,000 acres they sold for \$42,500 was resold a few days later for \$37 million. Did that make Uncle Sam mad enough to change the law? Har de har. Some of the \$2.50 parcels of land are near the gambling casinos in Las Vegas and have appraised values up to \$47 million.

Nearer to our hearts is the Incredible Uncle Sam (and that means us taxpayers, buddy) giveaway of radio frequencies. We're giving away our radio and TV channels for free, even though the users are making billions

Continued on page 82

using them. Ditto cellular telephone channels, and so on. Isn't it about time we started getting a piece of the action back from these humongous industries which are using our property to make money?

If someone set up shop on your front lawn and started selling things, wouldn't you at least expect a cut of the action? When you open a store in a shopping mall you have to agree to pay a percentage of your sales to the mall in exchange for the location. Is there any reason we shouldn't ask the commercial radio and TV users to pay maybe 10% of their revenues for the use of our property? That would add a few billion to the Treasury. The estimate is that we're giving away \$32 billion just for the cellular channels.

Of course, until you get Congress to change, all more revenues will mean is more spending. It won't cut our taxes one nickel. There are tons of ways for Congress to cut spending, but none of them are yet deemed necessary. What most people don't understand is that no one is actually running the government. Congress makes laws and the president handles foreign policy and is commander in chief of the military. But there's no one minding the store, so we see endless bureaucratic waste, with no easy way to curb it.

Waste? How about \$4.9 billion a

year for outside consultants for government bureaus? That's according to the government accounting office. How about \$1.5 billion for Congressional staffs? We could cut \$30 billion if we ended farm subsidies, and that doesn't count how much we'd save on lower food prices, which are now being supported. Then there are failed farm loans, where we've donated about \$10 billion to the farmers. We might want to cut down on the \$22 billion in food stamps too.

I'll be writing about this in more detail in my *Declare War Update* newsletter, which genuine Wayne Green-haters should consider buying, as it will give them plenty more to hate. There are some fascinating recent books which go into the gory details on how Congress is screwing us, but a warning . . . they could possibly make you mad. They could even put a strain on your 12 to 16 years of conditioning in our school system to not cause trouble and to do as you're told. I know I almost got mad. Worse, it almost made me think!

One of the most amusing books on government waste is O'Rourke's *Parliament of Whores*. P.J. shows how Congress could quickly cut \$337 billion off the budget, without even getting to the small, half-billion-dollar, items. Then there's Gross' *Government Racket—Washington Waste*

From A to Z. And if that doesn't hold you, check out Kelly's *Adventures In Porkland — How Washington Wastes Your Money and Why They Won't Stop*. These are just new books on the subject. There's nothing new about egregious waste in Washington. I've got stacks of books going back 10, 20 and 30 years, all describing the waste . . . and nothing has ever come of it . . . or changed.

The probability is high that nothing will change this time, except that the deficit and taxes will continue to rise.

Continuing Unemployment

I see they're extending the unemployment benefits because people aren't finding jobs. I think I know what's wrong. I've talked with some local businessmen and find they're having the same problem I am. They need more people. They're desperate for more people. But the job applicants just aren't what they need.

What's happened in New Hampshire . . . and all around the country . . . is that larger firms have been laying off their high-priced mid-management staffers. These people have been used to making \$50,000 and up a year, but having worked in mid-management, they've little experience or confidence in making decisions. What the smaller businesses need are people who can start at

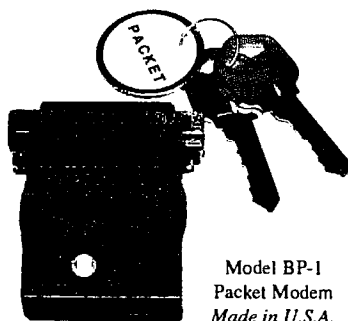
around \$20,000 and work their way up by generating sales. Someone who's geared to making \$50,000 has the wrong house, car, clothes, outlook, work habits, eats at the wrong restaurants, and so forth. Worse, they're used to that and are not much interested in settling for a \$20,000 lifestyle. So the job market is glutted with over-priced, under-trained people. Meanwhile, small businesses which need more help aren't able to find anybody they can hire. There just aren't many unemployed who can satisfy the needs of small businesses.

I have some great openings here . . . on 73 and *Radio Fun*, and to help start a couple new magazines, but finding people interested in actually working hasn't been easy . . . and we've been interviewing for months.

Ooops, a Typo!

Morris Blechman N9GVA was understandably upset when our data input person managed to let her subconscious alter his letter in the March issue. He ended his letter saying, "Anyway, I am going to send \$ for your ranting and raving." Naturally this got changed to, "There isn't any way I am going to send \$ for your ranting and raving," slightly altering the meaning. Tsk.

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CIRCLE 268 ON READER SERVICE CARD

David Cassidy N1GPH

Hams In Low Places

It appears that the FCC has finally given up on the notion that the Amateur Radio Service is self-policing, especially when it comes to the odd assortment of human flotsam and jetsam that washes up on 14.313. The FCC has finally answered the cries of the thousands of amateurs who operate legally and courteously, by stepping up their monitoring of the 14.313 cesspool and passing out some nice fat fines. Bravo, FCC! Please, keep up the good work.

When you add in all the other hams who have found themselves on the fuzzy end of the legal lollipop stick, amateur radio is starting to look more like *America's Most Wanted*. We've got illegal VE testing sessions, we've got false distress calls on the high seas, and of course there's always the illegal long distance exploits of everybody's favorite big mouth, Herbie Schoenbohm KV4FZ. It seems that Herbie, who has so far avoided an FCC Notice Of Apparent Liability (though many of us are still hoping), has also avoided any kind of serious penalty for his theft of long distance service. He was originally convicted on three counts, but an appeal got him off two of them. He was sentenced to two months of house arrest (kinda like being grounded, except it's by a judge instead of your parents), and ordered to pay a \$5,000 fine. Herbie has reportedly vowed to appeal the remaining conviction, all the way to the United States Supreme Court. It always amazes me how biowhards and big mouths who get caught with their hands in the cookie jar think they can appeal their little case to the Supreme Court. Herbie should read a book or something, because I can guarantee him that the Supreme Court won't be interested in reviewing his case. Of course, it is mighty difficult to hear and learn something when your mouth is always open.

I have to admit, I am a bit biased when it comes to discussion of Mr. Schoenbohm (watch out, faithful reader, here comes the dreaded "personal anecdote"). Other than my fundamental dislike for ignorance that passes as insight because of sheer volume, I have had a single personal contact with Herbie that left me less than impressed. It was the week we started sending American troops over to Saudi Arabia in Operation Desert Shield, what would eventually become Operation Desert Storm. I was driving home from work and turned on my HF mobile rig. I finished a nice chat with a fellow in Manchester, England, and was tuning up the band, when I came upon KV4FZ's afternoon speech. He and a buddy of his were operating a phoney net. They were being so ludicrous that no one would have mistaken what they were doing for anything other than a joke. I have no problem with jokes. I had a major problem with what Herbie chose as the subject of his joke. He and his buddy were acting like some kind of para-military relief net for the operations in Saudi Arabia. Even if I didn't have two relatives who had been part of the operation (which I did), and no matter how I felt about President Bush's decision to send American troops to that Godforsaken part of the world (I had mixed feelings), I still think that what Her-

bie and his pal were doing was in poor taste.

I sent out my call sign, was recognized, and had a short conversation with KV4FZ. I asked him if he could see how many people wouldn't find his joking about a potentially deadly situation involving American soldiers humorous. Herbie launched into some incoherent diatribe about how we had no business being over there, and how Bush was a dupe of the oil companies, blah, blah blah, yuck, yuck, yuck. I returned and told Herbie that most people didn't care about the political or corporate ramifications of Operation Desert Shield. I told him that it wasn't about Bush, or oil companies, or American-Israeli relations or any other complex matter. Once we had American men and women camped out on the sand of Saudi Arabia, it was a simple question of how many of those young Americans would die before it was all over. I guess this concept was too large to fit Herbie's narrow frame of reference. I don't think he understood what I was trying to say, so I signed off. Herbie and his buddy continued their fun and games.

While Herbie has yet to get caught in the act of pulling illegal amateur radio tricks, others have not been as lucky. William Moskowitz KA3HSZ of Plano, Texas, will soon be cutting a check to Uncle Charlie for \$2,000. Billy-boy is getting off easy, because it's his first offense. The base amount for malicious interference is \$7,000, but the FCC said they'd give Bill a break this first time. Mighty nice of 'em, doncha think?

The FCC wasn't as lenient with big-time offender Richard Whiten WB2OTK of Taylors, South Carolina. Dickie will soon be "contributing" a whopping \$10,500 to the national debt. The FCC stated that they were really socking it to Dick because of "repeated violation of rule 97.01(D)." Actually, I suspect that Whiten got slapped with such a stiff penalty because his defense was so lame. He didn't deny making the transmissions in question, but said that they weren't malicious interference because "if I had truly wanted to willfully and maliciously interfere, I could have done so to such an extent that communications between other amateur radio operators would have been impossible." Is that not priceless? Maybe we should call this the "Big Gun Defense."

Of course, I do have to express a little sympathy for Mr. Whiten, since the guy he was accused of maliciously interfering with was Michael Galego KA4MUJ. Mikey hasn't paid the piper yet, but like his buddy Herb Schoenbohm KV4FZ, it's just a matter of time before the FCC catches him doing something. KA4MUJ is perhaps the most frequent call sign heard on 14.313. Not only is he on the air himself at all hours of the day and night, but others make tapes of his inane ramblings and play them back over 14.313 when he's not around. When he is understandable (his words are so often slurred that it is difficult to understand what he's saying), Mikey can come up with some of the most hateful, ill-informed, anti-Semitic crapola this side of a skinhead convention. He adores Herb Schoenbohm to the point of suspicion, which is reason enough to question his

Continued on page 75

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

The following times are given in Co-ordinated Universal Time (UTC), which used to be called Greenwich Mean Time (GMT). When using the band-time-country chart please note that highest possible frequency is used for the path indicated. For the WARC bands, use as follows: for 12 meters, use 10 and 15 data; for 17 meters, use 15 and 20 data; and for 30 meters, use 20 and 30 data. Sometimes a path will open on a band higher or lower than the one indicated, so be sure to check those as well.

The propagation report for May contains some days that are Very Poor or Poor. These are expected to occur on the 4th, 9th and 10th; on the 16th through the 18th; on the 21st through the 22nd; and on the 25th. You will note that there are only 12 Fair or Fair-to-Good days forecast. May will be a month of unsettled ionospheric conditions and an active-to-storm level magnetic field on the days shown as Poor or Very Poor. Also, some intense geophysical effects may be noticed on the days surrounding the 17th of the month. Quite often you will notice that the forecast conditions take place a day or two before or after the forecast date, so always check the WWV broadcasts at 18 minutes after any hour to discover the trend in solar flux, and the Boulder A and K indexes. Remember that the higher the solar flux, and the lower the A and K indexes, the better the propagation will be.

May is also a month for trends from spring propagation (usually quite good) to summer conditions (usually quite poor as compared with spring and fall). The reason for this is the higher-than-usual absorption during the hours after noon, particularly on the lower HF bands. The ionosphere tends to be a poor reflector during those hours. Short skip on the higher HF bands will be quite good on many days as these frequencies are less affected than the lower ones. You may have noticed that the 30, 40, 80 and 160 meter bands are always better during early morn-

ing and late afternoon and evening hours. May always brings increased thunderstorm activity in the Northern Hemisphere, so QRN will be high on many days.

Note, also, that we are now in the last few years of declining sunspot activity when the higher HF bands will suffer the most. Therefore, you will find that working DX is more difficult in general on the bands from 10 through 20 meters. So, as the fanners say, "Make hay while the sun shines," which also applies to our radio activities in the years of declining sunspots.

There will be a partial eclipse of the sun on May 21st and it will cover North America, except for the Southeast, Arctic regions, Greenland, Iceland, Northern Europe (including the northern British Isles) and the northwest portion of the former Soviet Union.

Let me know how these predictions are working out for you. I'd like the feedback. See you next month.

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	-	20	-	-	-	20	20	-	-	-	-	-
ARGENTINA	-	-	-	-	-	-	-	-	-	10	10	15
AUSTRALIA	15	-	-	-	-	-	20	20	-	-	-	15
CANAL ZONE	15	20	20	40	40	-	20	20	10	10	10	10
ENGLAND	-	-	-	-	-	-	-	-	15	15	-	-
HAWAII	15	20	-	-	40	40	20	20	-	-	-	15
INDIA	-	-	-	-	-	-	20	20	-	-	-	-
JAPAN	-	20	-	-	20	20	-	-	-	-	-	-
MEXICO	15	20	20	40	40	-	20	20	10	10	10	10
PHILIPPINES	-	-	-	-	-	-	20	20	-	-	-	-
PUERTO RICO	15	20	20	40	40	-	20	20	10	10	10	10
SOUTH AFRICA	-	-	-	-	-	-	-	-	15	15	20	-
U.S.S.R.	-	-	-	-	-	-	-	-	20	20	20	-
WEST COAST	20	10	10	10	10	10	-	-	15	15	15	15

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	-	-	-	-	-	-	-	-	-	15
ARGENTINA	15	20	20	40	-	-	-	-	-	-	10	15
AUSTRALIA	15	20	20	-	-	40	40	-	-	-	-	15
CANAL ZONE	20	20	40	-	-	-	-	-	15	15	15	15
ENGLAND	-	40	40	-	-	-	-	-	15	15	15	20
HAWAII	15	20	20	40	40	40	20	-	-	-	-	15
INDIA	-	-	-	-	-	-	-	-	-	-	-	-
JAPAN	15	20	-	-	-	-	-	-	-	-	-	-
MEXICO	20	20	40	-	-	-	-	-	15	15	15	15
PHILIPPINES	15	-	-	-	-	-	-	-	-	-	-	-
PUERTO RICO	20	20	40	-	-	-	-	-	15	15	15	15
SOUTH AFRICA	-	-	-	-	-	-	-	-	-	15	15	20
U.S.S.R.	-	-	-	-	-	-	-	-	-	20	20	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	15	20	20	20	20	20	-	-	-	-	15
ARGENTINA	15	20	40	-	-	-	-	-	-	-	10	15
AUSTRALIA	15	20	20	-	-	-	-	-	-	-	-	15
CANAL ZONE	20	20	40	40	20	-	-	-	20	15	15	15
ENGLAND	-	-	-	-	-	-	-	-	-	20	20	20
HAWAII	20	20	20	40	40	40	20	-	-	-	-	15
INDIA	15	15	15	-	-	-	-	-	-	-	-	-
JAPAN	15	15	20	20	20	20	20	-	-	-	-	15
MEXICO	20	20	40	40	40	40	20	-	-	-	-	15
PHILIPPINES	15	15	20	20	40	40	-	-	-	-	-	15
PUERTO RICO	20	20	40	40	40	40	20	-	-	-	-	15
SOUTH AFRICA	-	-	-	-	-	-	-	-	-	-	-	-
U.S.S.R.	-	-	-	-	-	-	-	-	-	-	-	-
EAST COAST	20	10	10	10	10	10	10	-	-	-	-	15

Numbers possible on good days only

MAY 1993

SUN	MON	TUE	WED	THU	FRI	SAT
						1 F-G
2 G-F	3 F-P	4 P	5 P-F	6 F-G	7 G-F	8 F-P
9 P	10 P	11 P-F	12 F	13 F-G	14 G-F	15 F-P
16 VP	17 VP	18 P	19 P-F	20 F-P	21 P	22 P
23 P-F	24 F-P	25 P	26 P-F	27 G	28 G	29 G-F
30 F	31 F					

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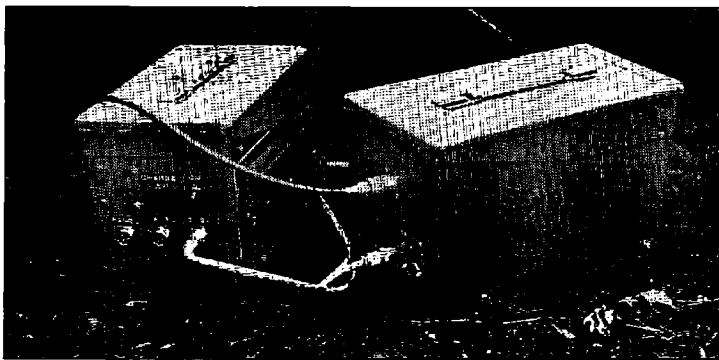
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Wayne Green W2NSD/1



Another Extra Class Convicted!

Of course it's just coincidence that the hams who have been arrested and convicted of crimes have all been Extra Class. We all know how bad the language on CB can get. Well, two people have been arrested and convicted for the outstanding use of foul language on CB and both were Extra Class hams. Now I see that NS3K has been arrested for transmitting false distress signals on 14.313.

So much for the baloney about Morse code keeping the riffraff out of our hobby. More likely it's keeping out good guys, otherwise we'd be seeing some of our thousands of no-code Techs getting into trouble.

Now, for you knee-jerk liberals, I'm not putting down the code as a fun aspect of the hobby. It only seems to help unbalance a small percentage of us, so it's probably a reasonable trade-off. I believe NS3K might be able to make a good defense if he pleads that the Morse code so scrambled his brain that he was unable to function within accepted limits.

And I'm not saying that all Extra Class hams are crazy. Not all. But I'd sure like to hear from any Extras who think they can round up at least three non-hams who know them and who will attest to their possible sanity. I don't expect much mail.

Did KV4FZ Poison 14.313?

There is strong evidence that 14.313 has been infected with a debilitating virus for which no known cure has yet been discovered. There seems little question but that Herb Schoenbohm KV4FZ is the ham responsible for releasing the virus. He is, by the way, an Extra Class ham. You've probably read about his conviction for phone service theft.

Almost everyone who tunes up on 14.313 seems to come down with the virus. The best bet is to not even listen to the frequency. Perhaps Dick Whiten WB2OTK can get his \$10,500 fine for jamming 14.313 reduced if he pleads temporary insanity caused by Herb's virus.

If the FCC is actually able to collect anything on fines for outstandingly bad operating on 14.313, they may have a

new source of revenue which could significantly help the Treasury balance off some of the pork barrel waste we can't stop our congressmen from passing into law. Sock it to 'em, Charlie.

Wayne Green Falls Again — Totally!

It's almost enough to discourage someone . . . at least someone not afflicted with a Never Say Die complex. No doubt a genetic mishap. I'm talking (well, writing, actually) about my abysmal failure to get you to keep notes when you buy a new piece of ham gear and let me know how it does for you. I want to know about any problems you have; any successes; how much fun it is; and so on.

I happen to know you're buying ham gear. I know you're buying new transceivers, new antennas, stuff for packet, RTTY, and so on. What I don't know is how much trouble you've had getting it going. I don't know what modifications you've cooked up. I don't know how your dealer has done in helping you, or how the manufacturer has been about helping you. I'm not up here in an ivory tower in New Hampshire, so let me know what's going on.

Other than the usual crapola on 14.313, what frustrations have you with the hobby? Look, we don't have a part of the ham exams designed to eliminate the insane, so we're going to have to deal with a level of fruitcakes. As I've explained, our school system guarantees that we'll have a disturbingly high percentage of people who are uncreative, angry, subservient, and prone to religious causes such as environmentalism.

Worse, there's more than enough evidence to convince me that there's a real possibility that the Morse code itself may be contributing significantly to unbalancing those without a tight grip on reality. I wish the ARRL would cooperate with researchers in fields like this, but of course, as a true-blue dedicated CW organization, I can understand their reluctance to let this can of worms be opened.

We don't know how much the code damages us via just hearing it, and how much may be due to the sharp square-wave pulses of high energy RF from our linears. I guess the best approach is just to deny the whole thing and not worry about it, and to heck with the re-

search already done. Scientists are always being proven wrong, right? Just remember a short while back to the nuclear winter, acid rain, ozone depletion, and carbon dioxide panics. Oh yes, and Alar. And weren't we running out of oil pretty soon?

A Ton of Reviews

If you're interested in buying a new piece of ham gear, you sure want to know what you're getting into before you run up your MasterCard account. That means you want to check out a product review. Well, guess which ham rag has the most reviews? And has 'em first? You probably guessed.

In 1992 we ran 33 reviews, and not one of these products was reviewed in *CQ* or *QST* before we published ours. Not one! Heck, we beat *QST* on the AEA FSTV system by 21 months, the Ameritron linear by 10 months, the Command Tech 2m linear by 19 months, and so on. How about the Drake R8? We beat 'em by 16 and 17 months on that one! These are supposed to be new equipment reviews, not old equipment reviews. The other two magazines reviewed only 25 products each in 1992.

If you've got the background and enjoy writing, you can do worse than volunteer to do new product reviews for us. The prestige is awesome; the pay sucks.

I started off asking for you to let me know your reaction to anything new you've bought. This holds even more for kits. I've had a couple grumbles about some kits, but then I've gotten enthusiastic letters from others about the same kits. If you put together a kit please let me know how it does for you. I want to know if it's a good bargain. Does it do what it claims?

In these days when parts for building are almost impossible to find and circuit boards are full of ICs, we're very dependent on kits for our building fun. Having spent many years at the workbench and still having a bunch of my old homemade stuff out in the barn, I want to do all I can to help newcomers to the hobby to find out how much fun it is to build stuff. I'd love to knock together some kits, but every time I start to buy one I get honest with myself. I look at my desk, with a stack of unanswered mail. I look at the homework I need to

do to put out my *Declare War Update* newsletters for the New Hampshire Economic Development Commission and our legislature. Sigh. Plus, I want to get to Dayton for a couple days, and I have talks scheduled with a growing number of chambers of commerce and Rotary Clubs. So, I tell you what, I'll do my Don Quixote bit, railing against the political windmills, and you put the kits together and let me know how they've done for you.

Cellular and Cancer

As a radio expert you're expected to be able to advise people on how serious this cancer business is for people using cellular telephones. I like the statement by a Motorola researcher that he would not use one for more than 30 minutes a day.

Yes, there is a lot more to be learned, but that doesn't mean that there isn't convincing evidence of the connection. The weasel-words are that we don't yet know how this happens. That's the same excuse the tobacco companies' paid scientists are using to say they've not yet seen evidence that convinces them of the tobacco-cancer connection. If I were being paid as much as they are I'd probably have trouble being convinced too.

If you've kept up with Ross Adey (K6UI) and his experiments, you know he's proven a connection between 450 MHz RF and cell growth changes. We're still learning about how cells work and how they communicate. There are both chemical and electric communications, either (or both) of which could be affected by magnetic or radio fields. There could even be other communications systems.

If you watched the PBS program on sharks you know that some species of sharks can track fish by their electric fields . . . and this is in salt water! Now, if this system is built into sharks, which have been around for hundreds of millions of years, we might want to find out more about how this works and see if something similar is at work in our bodies.

One thing that has really upset researchers is the incredibly low field strength of low frequency magnetic fields which can cause cellular changes. These fields are far more destructive than ever imagined.

With RF it may turn out to be more the modulating frequencies which are detected by our cells than any effects from the RF itself. This is why a couple years ago I suggested that we not put HTs to our head when PL tones are being used. Until Ross and the other top researchers in this field prove that RF is harmless, you have little to lose by considering it a potential danger and keeping your head away from RF. Heck, keep your whole body away from it.

I've been joking . . . sort of . . . about how CW operators are crazier than the rest of us. Well, there's some reason to believe that high-powered RF and power line magnetic fields from a CW-keyed rig just might screw up our cells beyond the ability of our system to self-

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From the Hamshack

Klaus Spies WB9YBM, Niles IL Wayne, as one who wants to be an entrepreneur, I thought it's about time I came out of the closet to agree with all of those times you tried to motivate everyone in your "Never Say Die" column. You're right: We should get our fannies in gear, do what we enjoy, and make a living at it. You've set the example with your undertakings.

I've never been certain of what to start an entrepreneurship in (problem number one), and (problem number two) after getting laid off from a job of nine and a half years (as an engineering technician for Motorola), I've been banging my head against the wall trying to figure out how to go about putting into practice what you've been talking about all these years.

Have you thought about writing a "How-To" book for entrepreneurs who want to start an entrepreneurship? (Doing an entrepreneurship on a limited budget would be a topic I'd like to learn more about, too!) You can put my name on top of the list of those wanting to buy a copy. I'll also be willing to bet that if you print this in 73's "Letters" column there'll be a bunch of people out there who'll beat your door down for their own copies of this book!

Ron Koyich VS6BD, Hong Kong Way to go, Wayne! Thank you for another excellent editorial, this one in the January 1993 issue, on health and child-rearing. I feel badly about not giving more thought to the subject before I had a child. Hopefully it will benefit the unborn of those parents-to-be who read it. Maybe not, though, when you consider how many young people do things without much consideration of the consequences. I know I did.

It's never too late to change our attitudes, however, and to embark on a journey of learning more about ourselves. Your editorials have no doubt had some influence on me—for that I thank you.

On the subject of health, a book that my wife and I have enjoyed is *Perfect Health* by Dr. Deepak Chopra. It explores mind/body connections.

Bob Brobst WB9UOF, Alexandria IN In case you get the feeling that no one reads your articles, I want to let you know that I enjoy your controversial editorials. I wish your comments on electrical hazards around us had been published earlier as our daughter-in-law recently lost her premature daughter, very likely due to complications from her computer use of eight to 10 hours a day as a sales rep. Keep up the good work in bringing information to us in a method that makes us think and search for more

information on our own, even when many times we don't feel like we have the time to spare.

Bob, I've been warning about magnetic fields for several years now. You must have missed some of my editorials . . . Wayne

William B. Maddock WA0AIZ, Florissant MO Regarding your March "NSD" column: Aha! I can't believe that an intelligent American in 1993 still believes that the Japanese really surprised Roosevelt or that U. S. military intelligence let the country down. I worked as an intercept radio operator and cryptographer and I worked with men who were assigned to the Naval Intelligence Unit at Pearl Harbor. The Intelligence Unit did its job! On December 1, 1941, the entire Imperial Japanese Fleet in the South China Sea changed call signs and codes. Also, in the ensuing week, the biggest Japanese secret regarding the attack was masterfully put together by Naval Intelligence at Pearl Harbor. The secret: One flotilla was to observe strict radio silence—the flotilla which attacked Pearl Harbor. This flotilla complied to the letter. Not a peep or key click out of them.

Our guys out-foxed this plan and within three days a complete call sign matrix was reconstructed from transmissions made by the rest of the fleet. One flotilla was missing. Conclusion: This flotilla was the one sent to attack the U.S. Almost at the same time a spy was caught noting berthing information at Pearl Harbor (which everyone conceded would be the target anyway, if war came). Condensation of the above: One week before the attack, experts in the field of Communications Intelligence saw what they knew, given the situation between Japan and the U.S., i.e. the call sign and code change at the same time could mean only one thing—war, and war in a very short time. WASHINGTON WAS NOTIFIED BY TOP SECRET MESSAGE. Also, every commanding officer in the Pacific was notified. Three days later, confirmation that an entire war-strength flotilla had broken off from the main fleet and had maintained total radio silence. WASHINGTON AND PACIFIC COMMANDERS WERE UPDATED. During this week, with no reply from Washington, General Short, Army Commanding General in Hawaii, made several significant steps to prepare for attack, including relocation of most of the B-17 bombers to other airfields and airstrips in the Hawaiian islands to avoid concentration of these valuable long-range bombers. (Had he not done this, there wouldn't have been enough recon capability to find the ships which bombed Hawaii.) Admiral

Kimmel, the Naval Commander, permitted all the ships to steam right into their berths at Pearl Harbor as they had done for months. They all came into Pearl Harbor every weekend! Kimmel apparently didn't take any action to protect anything. He apparently had no confidence in Naval Intelligence. Both General Short and Admiral Kimmel were relieved immediately and retired from active duty shortly after the war started—and spent their remaining years in disgrace.

Linda KJ5FC and Dan N5UNU, Brenham TX We visited your boat (*USS Drum* in Mobile, Alabama) and read as much as we could of your newsletters. It was hard to read with so many folks coming through. We wish you a great year in '93—lots more good editorials and much more success with *Radio Fun*.

Thanks for the note, Linda and Dan. It was fun writing about our adventures during the war on the Drum, and publishing the stories in the Drum Newsletter. I probably should have made copies available to interested hams, but it just didn't occur to me . . . Wayne

Joseph Lively KJ5FS, Fort Worth TX Wayne, I must take some exception to your negative assessment of the "service" value of ham radio. I know that a large percentage of what one hears on the bands is far from service-oriented, but in this part of the country the SKYWARN nets on 2 meters perform a valuable service. Last weekend I attended a "SKYWARN School" and have just sent in my application to join RACES so that I can participate. I don't know about you, but large hail and tornadoes scare the #&%! out of me, and I like to be able to keep track of that stuff!

I hope you're wrong concerning the deleterious effects of magnetic fields; it seems like it's getting to where everything is bad for one's health. I think a lot of hams use a lot more power than they need to; many of them on 75 meters use 1500 watts to rag-chew when they could go barefoot and communicate just fine. I am in the process of setting up an HF station, and it'll be barefoot by necessity for some time! I hope the high-power guys don't blow me into the weeds. I don't care whether I'm "30 over S9" or not—I just want to be able to get through decently. It seems to me that if fewer people were so power hungry, there would be fewer strong magnetic fields for them to worry about. After all, the FCC regs state that one should use the minimum amount of power necessary.

Erling A. Gruel WB9QJD, Fond du Lac WI I've been a subscriber/reader off and on since the mid '70s when I got my first ham ticket. I got onto 2 meter FM, and thought repeaters were the best thing to happen to ham radio . . . little did I know. In the last several years, I've kept seeing packet radio editorial comments in

your columns, and just couldn't picture myself using a computer to communicate with other hams. Part of the problems was that I didn't really understand computers and the jargon very well . . . and was a bit afraid of it, too!

After one-too-many Wayne packet rantings, I got brave. I thought: Oh well, why not try it? So I assembled a budget computer system that everyone could laugh at (and some did!). For about \$200 I got an old Commodore 128, a couple of 1541 disk drives, a parallel interface (did I say that?), and an Epson 9-dot matrix printer. Then I really did it—for Christmas I had the wife give me an MFJ packet circuit card to fit into the back of the 128. Cheap, yes . . . but it works!

WOW! What a different world in ham radio! Yeah, I made mistakes (still do!), but I found my touch-typing handy here! After 40 or so days on the air, it's a real challenge, it's interesting, and it's FUN!

As a sideline, I learned more about computers than I thought I could, and now I even use the system for other things, like assembling frequency lists for my scanner radio from research into FCC records. Makes nice copy, and I don't have to have a lot of paper lying around . . . the whole thing is stored on disk until I download it to the printer! (Sounds like jargon to me.)

I always say, "You never get a 'bum steer' from Wayne!"

Dave Kaiser AL7HG, Dhahran, Saudi Arabia I have just received the January issue. You asked, why don't some hams get involved in packet? In my case, my interest in ham radio is as a rag-chewer and in getting to talk to a lot of different people in a lot of different places.

I am a sometimes DXer; I collect DX cards when I happen to run across one. I've averaged 10 cards a year since becoming a ham, and I probably got a lot of those during my first several years as a ham, and less since (perhaps due to better band conditions back in the '60s). If I were an avid DXer and interested in obtaining cards with the help of a DX association repeater, I might invest in packet, but I'm not THAT much of a DXer.

I presume many hams work in computer-related fields. I stare at a computer screen all day; I sure don't want to come home and do the same thing as a hobby.

In my opinion, the new law limiting scanner frequencies is TERRIBLE. We have technology available to do a lot of things, and hams have a license that theoretically permits them to use it, and yet it's possible for a self-interested group (cellular interests) to sneak through a law that has long-range effects on everyone. Many third world countries prohibit ham radio transmissions and the sale of ANY scanners. Is that next?

Domino's Pizza Delivery Driver Summons Assistance with Ham Radio

Only two days after receiving his ham radio license, Store 7036 driver Doug Graham KB7RKY used his newly-acquired skill to summon help to the accident scene he had just discovered.

Being the first on the scene, Graham jumped out of his vehicle and immediately investigated the wreckage for injured bodies. Relieved that there were no visible life-threatening injuries, Graham quickly and professionally used his amateur radio to call for help.

After following the standard emergency procedure for ham radio operators—calling "break, break, break"—Graham finally heard back from someone offering assistance.

"I put out a call to any ham radio operator in the Louiston/Clarkston valley for help," said Graham. "And then another ham operator (Betty Drinnon N7IPU) came back. She said, 'KB7RKY, how can I be of assistance?'"

After asking her to call the sheriff's department and Rescue One, Graham then moved his own car out of the roadway and began directing traffic around the accident. *Reprinted from the March 5, 1993 "Pepperoni Press," the newsletter for Domino's Pizza.*

FCC Proposes Ham Band Spectrum Sharing

Three FCC Public Notices were recently issued underscoring the fact that we as amateurs should get used to the idea of sharing spectrum with other services. Actually, most VHF and higher frequency spectrum is shared. The three news items that the FCC released concern the 1.25 meter, 70 cm and 33 cm ham bands.

Until August 1991, the Amateur Service had access to the entire 220 to 225 MHz band on a secondary basis. The FCC separated this shared spectrum into two exclusive segments. The primary reason given was to accommodate new narrowband technology which would not be compatible with amateur operations.

The Land Mobile Service got the 220-222 MHz portion for narrowband business radio. Ham radio was allocated the remaining three megahertz, 222-225 MHz. The biggest loss was at 220.5 to 221.9 MHz, which amateurs used for control links.

The FCC received more than 550 requests in 1991 asking that they review the 220-222 MHz reallocation. In response to these *Petitions for Reconsideration*, the FCC said they thought that in certain areas of the country, some relief was indeed justified. They said the Commission would entertain a request for replacement spectrum and asked the ARRL to make a specific proposal showing how ama-

teur operations could use shared spectrum without causing interference to existing users.

After considerable amateur and professional testing, the ARRL filed a petition with the FCC. They asked for access to 216 to 220 MHz on a shared basis to "... provide accommodation for ... present and future wide-band data intercity links and other point-to-point fixed amateur stations ... displaced from the 220-222 MHz band." The ARRL said it was not possible to relocate displaced data operations at 222-225 MHz due to the existence of extensive 1.25 meter repeater networks.

The 216 to 220 MHz band is primarily allocated in the United States to the Maritime Mobile Service. The *Automated Maritime Telecommunications System* (AMTS) operates 80 channels on this spectrum. To reduce interference, the League agreed that amateur activity at 216 to 220 MHz should be managed. A power level of 50 watts was suggested, as well as specific frequency coordination. On March 5th, the FCC released a bulletin stating that it would adopt a *Notice of Proposed Rule Making* to provide "... a secondary allocation for the Amateur Service in the 219 to 220 MHz band to be used for amateur auxiliary station (point-to-point) packet backbone networks and other amateur point-to-point fixed communications."

The Commission also recommended operating limits and other measures to ensure that these amateur operations do not cause interference to primary operations in and adjacent to the 219-220 MHz band. We will not know the extent of these controls until the exact text of the NPRM is issued.

On March 10th, the FCC proposed to allocate the 449 MHz band for wind profiler radar systems (sensitive pulsed radars that measure wind speed and direction at altitudes between 1,500 and 53,000 feet) and asked the public whether they should be accommodated in the 915 MHz (ISM) band as well. This really was not a surprise since the government has been investigating several VHF and UHF homes for wind profilers for several years now.

The first thing that comes to mind to most of us is that 420 to 450 MHz is allocated to the Amateur Service. Does this mean that the Amateur Service is losing access to more spectrum? The answer is no! We must remember that amateur radio uses the 70 cm ham band on a secondary basis. What it does mean is that we will be gaining another sharing partner.

The primary user of the 420-450 MHz band is Government Radiolocation. Government frequencies are assigned by the NTIA (National Telecommunications and Information Administration) and not the FCC.

The good news is that the impact on the Amateur Service should be minimal. Wind profiler radars are generally located in remote rural locations and not near the 30-mile radius of

most 70 cm repeaters located in population centers. Furthermore, the government has agreed to take whatever steps they can to minimize the impact of wind profilers on existing amateur repeater users, and installation of the wind profiler network is not expected to begin for another five to 10 years. That will allow plenty of time for repeater owners and wind profiler planners to determine what steps need to be taken to minimize interference to one another.

The 33 cm ham band at 902-928 MHz is lightly used by the Amateur Service. Theoretically, FM repeaters are supposed to be operating on the band with inputs at 906-909 MHz, matched with 918-921 outputs. Amateur TV and packet operation also have extensive ham band-planning at 33 cm. For the most part, however, 902-928 MHz is not used by the ham community.

Internationally, the 33 cm band is allocated to the Fixed Service on a primary basis, with Amateur, Mobile and Radiolocation secondary. The pecking order is slightly different in the United States where the primary users are Government Radiolocation and ISM (Industrial, Scientific and Medical) use. ISM bands are often referred to as "junk" bands since they provide a home for almost any device that radiates energy. Even microwave ovens cook on 915 MHz.

On March 11th, the FCC said they would be permanently allocating shared use of 902-928 MHz to Automatic Vehicle Monitoring (AVM) systems (used to locate and track vehicles using non-voice methods, and to relay information to and from vehicles). The FCC proposed to expand the service to encompass location of all objects, animate and inanimate, and to allow licensees to provide service on a private carrier basis to individuals, the federal government and business band users.

The AVM Service will be renamed the *Location and Monitoring Service* (LMS) which the FCC defines as the use of non-voice signaling methods from and to radio units to make known the location of such units.

The FCC suggested that wideband LMS systems be licensed on the 904-912 and 918-926 MHz bands and narrowband LMS systems at 902-904, 912-918 and 926-928 MHz. The Commission believes that wideband systems are capable of operating in a shared environment, but asked if there is a need to provide spectrum exclusively for some period of time.

Sharing our spectrum with other radio services and the U.S. government is covered in the Amateur Service Part 97 rules at section 97.303. Since the Amateur Service is a secondary user of all UHF and higher frequency spectrum, we simply have to accept any interference that might be generated by those services designated as primary and we must not interfere with their operation. *TNX W5YI Report, Vol. 15, Issue #7, April 1, 1993.*

The Ubiquitous Coaxial Connector

by Steve Katz WB2WIK/6

Connectors . . . can't live with 'em, can't live without 'em. Coaxial connectors, especially, are a real bugaboo for many hams faced with the challenge of installing them in a proper, professional manner and trying to keep the weather elements out of them for any length of time.

Fear not! Coaxial connectors are truly easy to install properly—it just takes the right tools and training (like any job). Luckily, the right tools are likely to be in your own toolbox, or at least at the local discount hardware store. Let's start with the most popular connector in amateur use for 1.8 through 220 MHz, the "UHF" type PL-259.

PL-259 "UHF" Connectors

PL-259 "UHF" connectors are so named because way back when they were invented, any frequency above 100 MHz was considered to be Ultra High. These were the frequencies of our earliest radar systems, and little work had ever been done, except by pioneering experimenters, above this frequency range. Since that time, we have redefined our spectrum to divide it up in "decade" (factors of 10) ranges, and UHF is now defined as 300 through 3,000 MHz. ("VHF," the next decade range below, is defined as 30 through 300 MHz; "SHF," the next decade range above, is defined as 3,000 through 30,000 MHz; etc.).

In any case, UHF connectors are badly misnamed because they really don't work at all well in the real UHF spectrum and their use should be confined to the MF (medium frequency), HF (high frequency, or 3-30 MHz) and VHF ranges. The reason PL-259s work so poorly at Ultra High frequencies is that they are not constant-impedance devices and their physical dimensions are such that they can appear as quite an impedance "bump" (or discontinuity) in the UHF range.

This bump can cause attenuation, which of course is normally undesirable, so PL-259s are best used in the frequency ranges where their impedance discontinuity will be of no consequence. (The bump is created by loose mechanical tolerances in the PL-259 connector design, as well as by variations in the dielectric materials used, construction by different manufacturers, and so forth.)

So, now that we know where we should be using UHF connectors—or at least where their inadequacies can be tolerated—let's install one on a cable.

The PL-259 is designed to accommodate coaxial cables measuring 0.405" outside diameter, like RG8A/U, RG213/U, etc. The rear (cable-entry) end of the connector *body* has internal threads which allow the connector to be literally screwed onto the mating cable's jacket, making a secure mechanical connection prior to any soldering operations.

If you have been installing PL-259s *without* screwing the connector body onto the cable jacket, you've been doing it wrong, and the results can be devastating to prolonged performance.

PL-259s can also be modified to accommodate the smaller-diameter cables, like RG58/U (and A/U, C/U, etc.), RG59/U and RG8X (or RG8M) "mini-8" cables. This modification involves using the correct "reducer" size, type UG175/U for RG58 and UG176/U for RG59 or RG8X, which is screwed into the rear end of the connector body as part of the assembly operation, and prior to any soldering. Whether using the larger-size cables (0.405" o.d.) or the smaller-size cables (which are 0.195" or 0.242" respectively), the rear-end internal threads in the connector body are *always* used.

UHF connectors are available in a variety of construction materials and finishes, but the essential dimensions should always be the same. Popular finishes include bright nickel ("Astroplate" from Amphenol, for example), silver plate, and gold flash. Popular dielectric materials include Rexolite, Phenolic and Teflon. Combinations of plating finishes can be found in a single connector. I find the easiest ones to work with are silver-plated (at least the *body* should be silver-plated, if not the connector shell), with Teflon dielectric. The reason for this is that

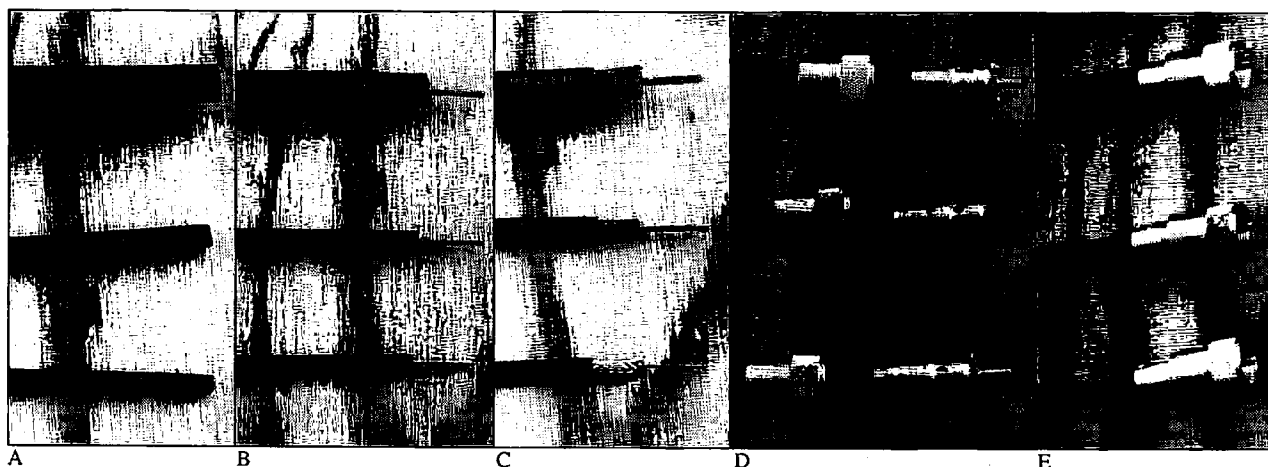


Photo 1.

the silver-plated body accepts soldering at a lower temperature than nickel-plated connectors will, making the soldering operation a much easier job; and the Teflon dielectric will withstand soldering heat better, and be less hygroscopic (will absorb moisture less easily) than other materials. The silver-plated Teflon-dielectric connectors cost a bit more than other constructions, but I find they're usually worth the small amount extra.

Installation

To do a professional job in the installation of a PL-259, you'll need an X-acto knife or a sharp single-edged razor blade (sold in wallpaper/paint shops for a few cents each in boxes of 24 or so), a sharp pair of scissors, similar to manicuring scissors (available in stainless steel for about \$5), and a heavy-duty soldering iron, usually a "gun," rated at 260 watts or more, like the Weller D550 or equivalent. It doesn't pay to try using a smaller soldering gun because the heat transfer to the connector will take too long and can cause damage to the cable. If you can't heat up the connector body to the solder-melting point (about 230 degrees C for standard 60/40 alloy solder) in just a few seconds, you're taking too long and will be frustrated. You'll also need some rosin-core solder, usually 60/40 (tin/lead ratio) or 63/37 alloy, 0.047" or 0.050" diameter. The most expensive item here is the big soldering gun, which could cost as much as \$50 or so if you don't already own one.

Prepare to work on a *non-metallic* surface because a metal surface will act as a heat sink and draw heat away from the connector so rapidly that soldering will become a difficult task. I do most of my PL-259 soldering on a slab of ceramic (like a large piece of ceramic tile from a bathroom, kitchen or foyer floor—available for free as "scrap" or "sample" from most flooring shops). Ceramic is an excellent material because it will withstand very high temperatures without burning and is a lousy heat sink.

Prepare the cable end for installation of the PL-259 as follows:

(1) Slide the connector "shell" or "nut" over the end of the cable, with its internal threads facing towards the cable end, and push it far enough down the length of cable so that it's out of the way.

(2) Use the razor blade to cut all the way through the cable jacket, braid, and dielectric materials, stopping at the copper center conductor (you can feel it when you hit this obstacle), using vigorous pressure at first to cut through the braid, then lighter pressure as you slice through the dielectric. Don't use so much force that you cut into the center conductor with the blade. If, after you're done, inspection reveals that you *have* cut into the center conductor a bit, cut off and discard this piece of cable and chalk it up to experience, then try again. With a bit of practice it is easy to know how much pressure to use and to stop applying pressure as soon as the blade touches the center conductor. Perform this operation at 5/8" (0.625")

from the end of the cable. Once you've successfully sliced through in one spot, hold the razor blade in a fixed position with one hand and rotate the cable 360 degrees so that it cuts in a similar manner all the way around the cable.

(3) When you're done, pull off the piece you've just sliced through, exposing 5/8" of undamaged center conductor (Photo 1B).

(4) Now use the razor blade to slice through *only* the cable jacket, which will not offer much resistance to penetration at all. Do *not* use enough force to cut into the braid material. Make this cut another 5/8" down the cable, or 1-1/4" from the end of the copper center conductor. Rotate the cable 360 degrees again, this time slicing through only the outer jacket material. When you're done, pull off the jacket material you've just sliced through, exposing 5/8" of nice, undamaged braid material (Photo 1C).

(5) Inspect the exposed cable end to be sure no braid "hairs" protrude beyond the freshly-cut dielectric material, risking short-circuiting to the center conductor. With practice, you'll find there won't be any hairs, especially if you use a new, sharp razor blade. If any braid hairs protrude beyond the dielectric and look like they might short circuit to the center conductor, use the small, sharp scissors to cut them off, one by one.

(6) Now, line up the connector body with the end of the prepared cable so that the center conductor will center itself with the 0.150" diameter center pin of the plug. If your coax has a stranded center conductor, inspect the strands to make sure they are tightly wound together, with no "rogues" sticking out. If any strands *are* sticking out, gently twist them back together by spiraling *in the same direction* as they already were in the fresh coax, making a neat, tight bundle for the center pin.

(7) Next, begin inserting the connector body onto the prepared cable end, twisting the body clockwise as you push gently on it. You'll find that within a very short distance the internal threads in the rear end of the connector body will "grab" the jacket material and bite into it quite well, resisting the rotation. Continue to gently push on the connector, while rotating it clockwise, until the cable is firmly "seated" inside the connector and no further progress can be made. At this point the center conductor should protrude slightly (about 1/8") from the end of the center pin hole (Photo 1D).

(8) Now you're ready to solder! The cable braid should be showing through all four PL-259 body "holes," which are there precisely for soldering. Place the connector down on your soldering surface with one body hole straight up, and place a gentle weight on the cable a few inches away from the connector to hold it in place. A heavy book is a good weight. Don't clamp the cable in a vise or anything that can crimp it too hard. Coax is fragile stuff. Pull the trigger on your soldering gun, and wait a few seconds for the tip to heat up to soldering temperature, which will usually be indicated by a bit

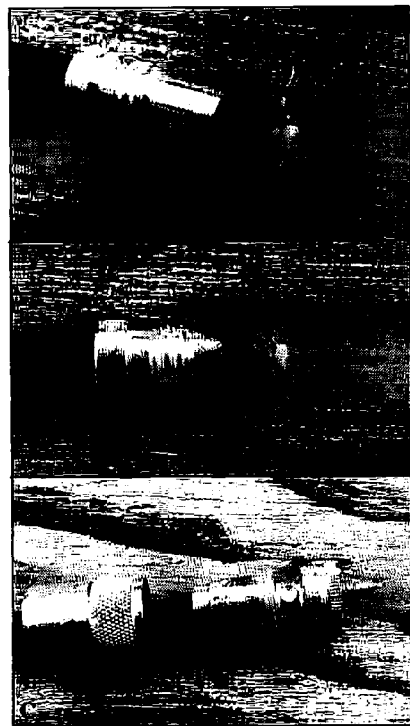


Photo 2.

of smoke coming from the tip. Holding the solder in the other hand, apply the gun's tip to the connector body, right over the soldering hole, and hold it firmly in place for a few seconds to allow the connector to heat up. Now apply a small amount of solder to the joint between the iron's tip and the connector body, and wait a few seconds for it to flow. Once the solder has flowed, move the iron's tip just a small distance (maybe 1/16") out of the way so the connector hole and braid are exposed, and feed the solder right into the hole. Wait another few seconds for the solder to flow into the hole and completely cover the braid and the hole. When the solder has flowed properly it will look bright and shiny, even after you pull the iron away.

(9) Now, rotate the connector 90 degrees and do the same thing in the next solder hole. This one will go much faster because the connector is already very hot. So hot, in fact, that you could burn yourself on it if you're not careful. (Some might want to use heat-insulating gloves for this whole operation to help prevent minor burns.)

The second solder hole should fill up in just two to three seconds. Now, rotate the connector body 90 degrees again and do the same thing in the third solder hole. Again, this should happen very fast because the connector is already at soldering temperature. Then, rotate 90 degrees again, and fill up the last solder hole with solder.

If you're doing it right, the whole soldering operation should take maybe 30 seconds or so. If it's taking longer than this, it's taking too long and one of the following might be occurring:

a.) Your working surface is drawing heat away from the connector—remember, don't do this on a metal surface!

b.) Your soldering gun isn't powerful enough. Try a bigger one—although the 260 watt model should be sufficient.

c.) Your connector body is not silver-plated, but it is plated with other metals that do not "wet" as well as silver. Or, maybe the connector is oxidized, in which case it should be thoroughly cleaned prior to use.

d.) Your solder is weird, and either lacks a rosin core (which is essential to dissolve oxides that form in the soldering process), or is some higher-temperature alloy. Check it out.

e.) You're not applying enough pressure between the soldering iron's tip and the connector body to get good heat transfer.

10) Take a short break to let the connector and cable cool off a bit. To accelerate this process, I often use a brief squirt of "circuit cooler" (available in any electronic parts store). These "coolers in a can" are made of chlorofluorocarbons (if you don't care about the environment) or chlorodifluoromethane (if you do) and release an extremely cold spray (so cold, in fact, that it can damage your skin if exposed directly), so if you choose to use it, be careful. A brief (two-second) squirt of this stuff will bring down the connector temperature very well, and it helps accelerate the process. If you don't want to use the cooling spray, wait a minute or so for the connector to cool down before proceeding. This is mostly to prevent damage to the cable dielectric, which will also be very hot and could deform if the cable and connector are handled prior to a cooldown period.

(11) Now you're ready to solder the center pin. Use the gun again, applying the tip to the junction of the wire conductor protruding from the pin and the pin itself. Apply a small amount of solder, and when it starts to flow, move the iron's tip slightly down the *side* of the pin to draw the solder down into the connector pin. Add just a bit more solder at the tip, and cover the exposed wire conductor and the opening in the end of the connector pin so there are no holes or gaps here. This operation only takes a few seconds to complete because the center pin is a much smaller heat sink than the connector body.

Wait several seconds for the pin to cool off. Use a sharp diagonal cutter to cut off any extra wire conductor protruding beyond the end of the connector pin. Then wipe the whole pin down with solvent (alcohol, trichlor, flux remover or whatever) and a soft cloth to remove any residual soldering flux. Inspect the pin for any excess solder that might have flowed down the outside of the pin. If there is any (with practice, there *won't* be), use a nail file or fine-grit emery cloth to remove the excess solder. (*Don't* use a large file or rasp, or large-grit cloth, or you risk removing all the silver plating from the pin, which will cause it to oxidize much more rapidly, leading to potentially

disastrous results in the field.)

At this point, you're finished, and, if you have used the spray cooler in step #10, the entire installation should have taken less than 90 seconds from beginning to end. If you waited for a "room temperature cooldown" it probably took more like 120 to 150 seconds. Under no circumstances should this operation consume more than 2-1/2 minutes, and with practice it will go faster and you'll still get professional results.

(12) Slide the PL-259 "shell" up the cable to the connector body, and screw it on to the connector body by twisting the shell clockwise onto the body. After a few twists, the shell should fall loose of the threaded area, enabling you to pull it all the way down the connector so the leading edge of the shell is about 0.150" back from being lined up with the end of the connector center pin (Photo 1E). That's it!

Modification for Smaller Cable

All the instructions thus far were for a standard PL259 assembly on to RG213/U or other 0.405" o.d. cables (RG8/U, etc.). A few modifications are required to the instructions if you intend to use the smaller cables which require reducers. Here are the modifications, in order (see Photos 2A, B and C).

Steps (1) through (5) remain the same. The changes for using UG175/U (for RG58-sized cables) or UG176/U (for RG8X cables) reducers begin with step (6).

(6) Slide on the appropriate reducer over the cable, with the large-diameter (big) end towards the balance of the cable and the smaller-diameter end facing towards the cable end you just stripped. The reducer should have a slightly snug fit over the cable jacket to work properly. If it slides on *too* easily (no force required at all), it will be difficult to make the connector assembly weatherproof. A too-loose fit indicates a non-standard reducer (check to be sure it's a real UG175 or UG176 type) or a non-standard (too small) cable diameter. This should *not* happen with mil-spec cables, but can occur with commercial types.

(7) Line up the small end of the reducer with the cut end of the coax jacket material so the reducer is flush with the cable jacket, where the exposed braid begins. Holding the reducer in this position with one hand, fold the braid back gently using your other hand. It will fold back easily. Gently pull it down, little by little, until it's all neatly folded back along the surface of the reducer. If you stripped the cable properly according to step (4), the braid strands should end exactly at the beginning of the threads on the reducer. If the braid strands end much *before* the threaded area of the reducer you didn't strip away enough jacket material in step (4) and you must start again. If the braid strands are so long that they overlap the threaded area of the reducer, they are too long and will interfere with the connector assembly. Trim the braid strands

back neatly using the small, sharp scissors until they all end right about where the reducer threads begin. The objective here is to avoid having the braid strands pinched between the reducer and the connector body.

(8) You will now find that a lot of dielectric material is exposed between the folded-back braid and the beginning of the center conductor. This is normal. The dielectric must be further stripped off the cable, 1/16" maximum from where the reducer starts, leaving at most 1/16" of dielectric material showing when you're finished. This will leave the stripped (exposed) center conductor quite long, but there is no harm in this because the excess will be cut off.

Now, skip to the *original* step (7), as printed earlier in this article, and follow those directions, *except* that instead of screwing the connector body onto the coax jacket, you'll be screwing it onto the reducer. These threads will mate perfectly if the reducer and the connector body are properly aligned and "squared up" with each other. When the reducer is fully threaded into the connector body, it should push tight up against the connector body, leaving no space between the reducer "nut" (large-diameter part of the reducer) and the connector body itself. If there's any space at all here, the reducer is not properly seated in the connector and this will present a problem with regard to completing the assembly, making it work, and making it weatherproof.

Continue with the assembly procedures detailed in the original steps number (8) through (12). If you have followed these directions precisely up to this point, the cable braid should be exposed through all four connector body soldering holes and the soldering and final assembly operations will be the same as for installing a PL259 onto RG213/U.

Final Notes

My directions differ slightly from those shown in the *ARRL Handbook* and other texts written on this subject in that I instruct you to cut braid and dielectric off flush, so they are both the same length (for the RG213/U assembly), rather than leaving some dielectric exposed between the end of the braid and the start of the exposed center conductor. From my 27 or so years of experience installing probably ten thousand of these connectors, my way works better and will result in a more rugged, reliable assembly. There is *no* risk of producing a short circuit in the cable using my method, if it's done properly, so there's no reason at all to leave any dielectric exposed at the end of the braid.

The photographs accompanying this article show how things look as they're going together, and how they should look when you're done. A properly-installed PL259 is so strong that it cannot be pulled off the cable even with a few hundred pounds of tension. When performing the "pull test" on

my cable/connector assemblies (that is, pull on the connector until something breaks!), I can always stretch and break the cable itself before the connector comes off the cable.

When performing step (2) of these instructions, where you use the razor to cut all the way through the jacket, braid and dielectric, but stop short of cutting into the center conductor, you will probably find it takes some practice to determine where to stop cutting and avoid damaging the center conductor. That's fine! Use a scrap piece of cable and make several cuts until you know just how much pressure to apply to get this right. In time, you'll get the "feel" of this, and then in the future it will be a breeze! Razor blades and knives are very sharp and even a small nick can cut a very deep gash in your flesh. You might want to use workman's gloves to help prevent cuts, or at least keep some Peroxide solution and Band-Aids handy to patch yourself up quickly in the event of a mishap (I've only cut myself about a million times doing this.)

So much for PL259s. My next article will detail the installation of higher-frequency connectors, the popular Type "N" and "BNC," which are usable into the SHF spectrum. These are easier, not more difficult, to install than PL259s, because no soldering of the braid is required.

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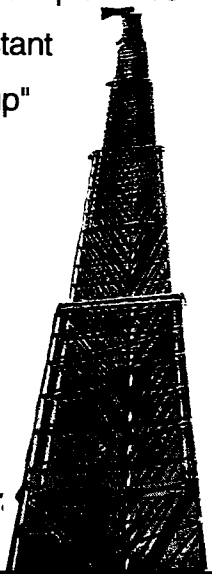
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Portable Packet Digipeater for Emergency Service

by John Neeley K6YDW

During the forest fire season, California has many major fires, some raging for several weeks. A call to amateurs for assistance in communications by various local, state and federal agencies is filled by the volunteers. During these disasters, the agencies involved need more portable packet stations and portable digipeaters. Some locations are not accessible directly from the stations at the remote fire camps due to mountainous terrain or other obstacles. The need for highly portable, battery-operated digipeaters is obvious. Packet stations are used to pass logistical messages to and from the camps, along with health and welfare messages from the firefighters.

The August and September 1987 issues of *CTM Magazine* contained a two-part article by Robert Hoover KA6HZF titled "Captain Kirk's Lunch Box," which was about a totally self-contained, battery-operated, solar-charged portable digipeater. Mr. Hoover's article dealt with a complete package housed in a single GI ammo box. It included a Yaesu FT-23 2 meter HT, an MFJ-1270 TNC and a single 14 amp-hour motorcycle battery, along with an external solar panel.



Photo A. The HT/TNC and battery box connected.

I thought this was a great idea, but I didn't have the tiny HT that Mr. Hoover had. I did have an older Kenwood TR-2500 2 meter HT as a spare, and a spare TNC, the MFJ-1270. Since the TR-2500 is much larger than the FT-23, I had to rethink how I could get this all into a compact package. The answer

was to use two boxes: one for the HT/TNC and the other for a dual-battery pack which also included the solar controller circuit board (Photo A). The following article is a guide to building your own unit, no matter

Continued on page 18



Photo B. Inside the HT/TNC box.

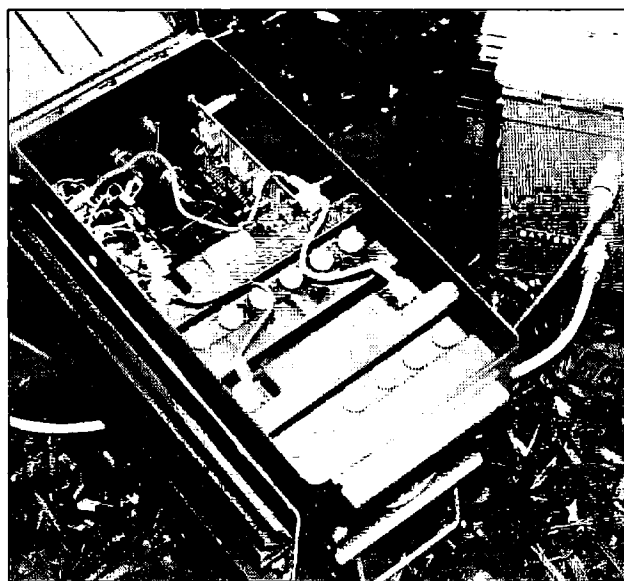


Photo C. Inside the battery box. The solar controller board is in the upper right corner.

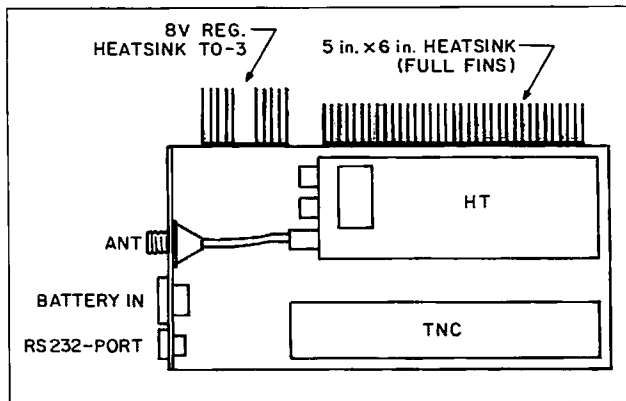


Figure 1. Radio/TNC box, top view.

Continued from page 16
what kind of HT or TNC you use.

Radio/TNC Box

The GI ammo boxes are the standard type of box found in most army surplus stores or at flea markets. The size of the box is 5-1/2" W x 7-1/4" H x 11-3/4" (Photo B).

How you prepare the mount for the HT or TNC inside the box depends on which brand you use. Most of the older type of HTs are approximately the same physical size so most will fit in the box the way it was done here.

The MFJ-1270 TNC must first be removed from its enclosure so it will fit inside the box. There are four mounting holes in the circuit board. Take a stiff piece of paper, the same size as the board, and mark all four holes. This will be the drilling template for the TNC board mounting holes. Notice that there is a 5 volt regulator on the end of the board. This must be mounted flush to the inside of the box. First, remove all five LED lamps as they are not required for digipeater

service. I did leave the "Power ON" LED, but bent it up into a position that would clear the inside of the box. This gives me an indication that there is power going to the box. Before mounting the TNC board to the box, using 1/2" metal spacers, first scrape away any paint from the area where the 5 volt regulator is going to touch and apply a liberal amount of heat-sink compound. Also, the top two mounting holes will require the use of flat-head type bolts instead of roundhead types. This allows the top lid of the box, which has some long sides, to clear the boltheads.

The mounting of the HT unit will depend on just what you are going to use, but most can be mounted in this fashion. See Figures 1 and 2. I used some scrap 1/4" aluminum plate for both the top and bottom shelves. The bottom shelf is bolted to a piece of 1"

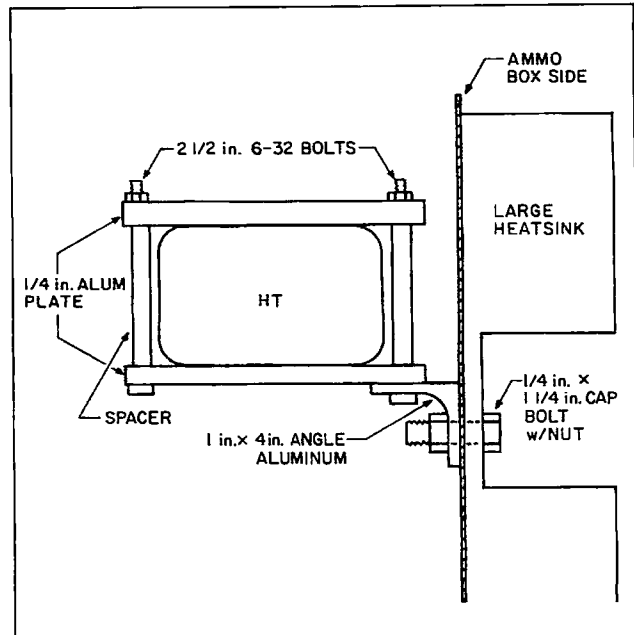


Figure 2. HT mounting scheme.

aluminum angle stock, approximately four inches long, and this angle stock is then bolted to the side of the box. On the outside of the box, where the bottom shelf attaches, is a large heat sink to dissipate any excessive heat generated either by the units inside or by any direct sunlight on the box. There are different ways in which the heat sink can be mounted to the surface of the box, depending on what style of heat sink is used, so I will not go into the details.

In cutting the bottom shelf for the HT, place the HT down on the plate and trace out the outer dimensions. Now, mark the plate 3/8" larger on all sides, as this will give

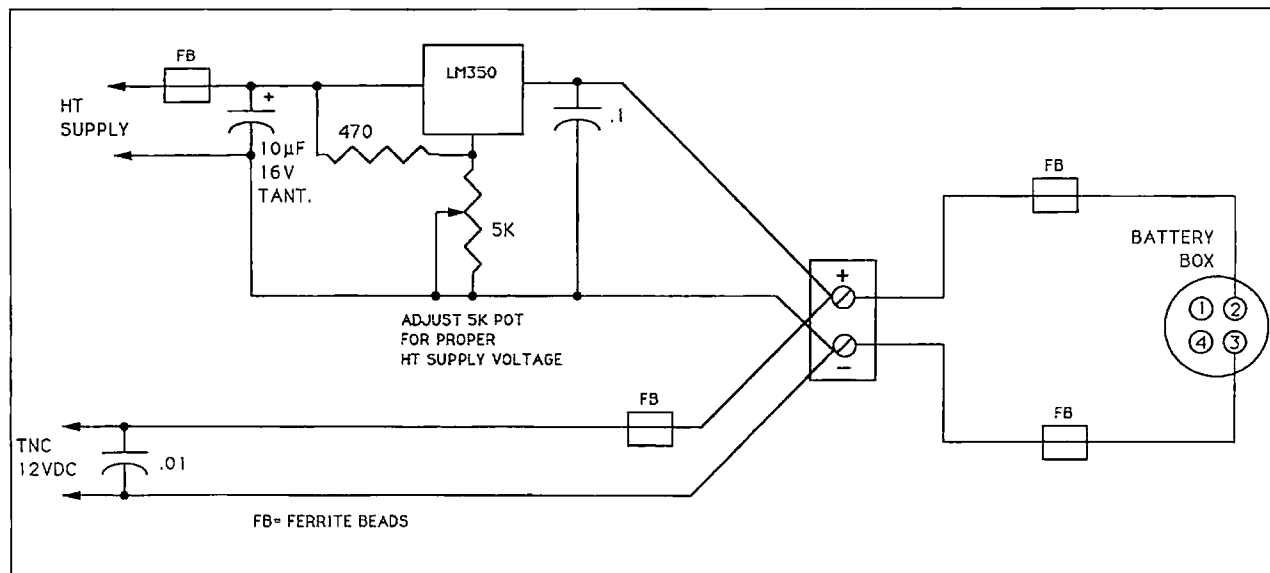


Figure 3. 1.2-32 volt variable power supply.

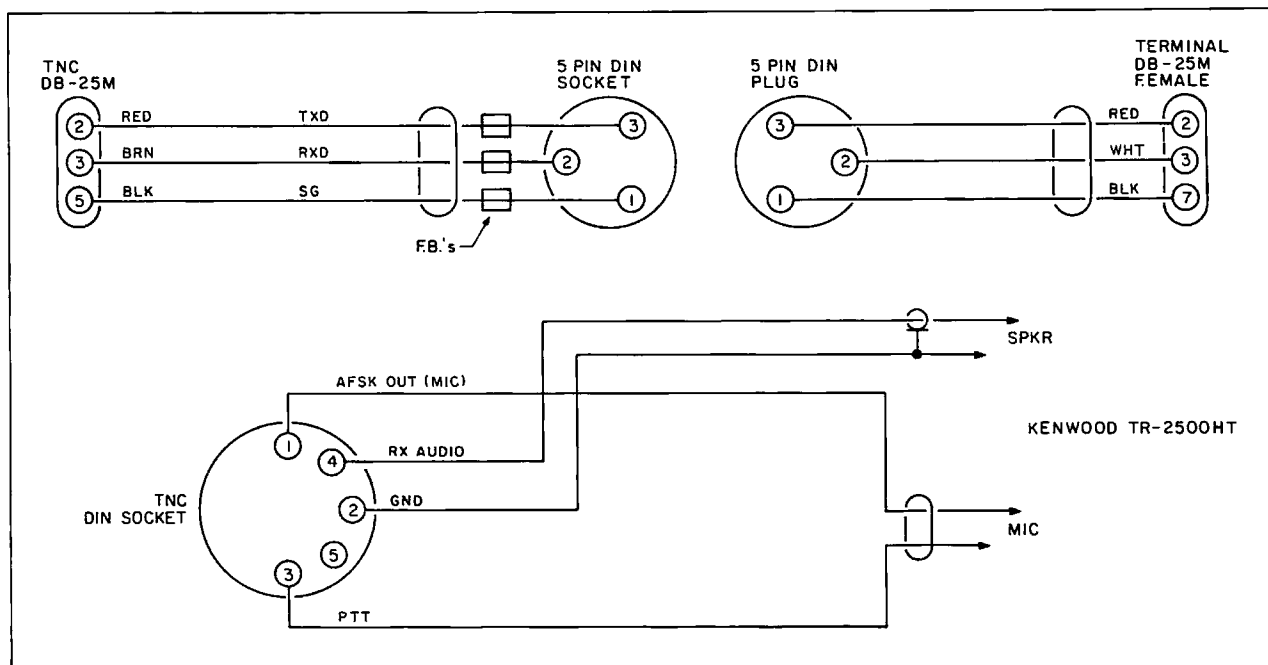


Figure 4. Detail "A."

room to place the mounting bolts. Make the top shelf the same size as the bottom, cutting out for any controls, displays, etc. I used 2-1/2" x 6/32" bolts, using metal spacers to get the correct height needed between the two shelves. Once they are tightened down the HT is very secure.

Three holes are required in the end of the box for the antenna output, the battery input and the RS-232 I/O port.

Since the Kenwood TR-2500 HT uses an LM-340-8K voltage regulator on the outside of the box, next to the large heat sink. Be sure to heat-sink this TO-3 package.

The power voltage required will depend on what HT you plan on using. Some use 12 volts, some less. For voltages other than 12 volts, a simple regulated supply is on the same board as the solar controller and uses a

LM350 regulator. The 5k variable resistor will change the HT supply voltage and can be adjusted for the TH you use (see Figure 3).

Different brands of TNCs are of various physical sizes. Some may mount in the box without having to remove the enclosure. Be sure that the TNC has a "watchdog" circuit to prevent a locked keydown condition. Some TNCs do not have this feature.

Since I planned on using the unit as a portable packet station, I put a 5-pin DIN jack on the outside of the box for my RS-232 I/O port. Placing a DB-25m plug on a 3-conductor ribbon cable, which connects to the DB-25f connector on the TNC, the other end is connected to the 5-pin DIN (see Figure 4). Place a single ferrite bead on each line to the DIN jack. Also, place as many ferrite beads as possible on all lines within

the box. This is just a precaution against any stray RF that may be floating around inside the box. [Note: I have had no problems with stray RF within the box and next to the bare board TNC, even with the plastic case of the TR-2500.]

Battery/Solar Charge Controller Box

I was unable to install a single motorcycle battery inside the same box as the HT and TNC so I had to get a second box. There was plenty of room inside this second box so I decided to use two batteries, which would give me a total of 24 Ah (see Figure 5 and Photo C). Mounting the batteries is fairly simple as they will fit in sideways, leaving approximately four inches on one end for the solar charge controller board and associated output jacks. Be sure to measure the size of the batteries to make sure they will

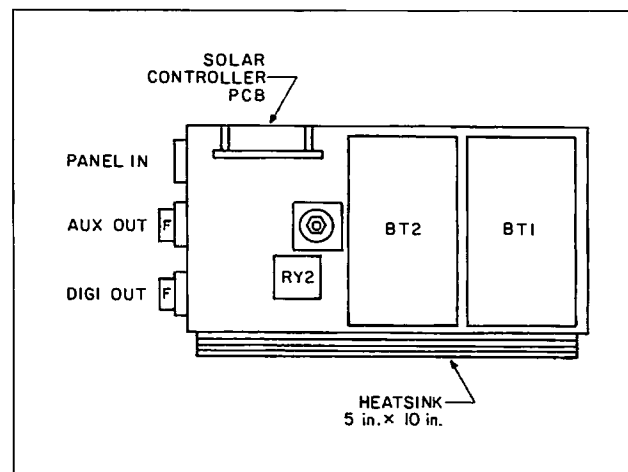


Figure 5. Battery solar controller box, top view.

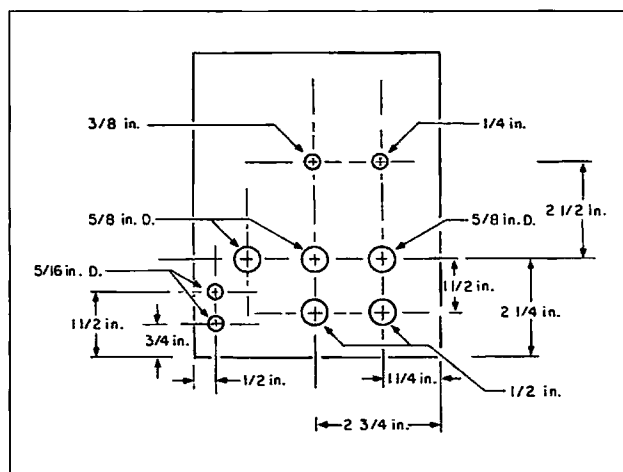


Figure 6. Battery box.

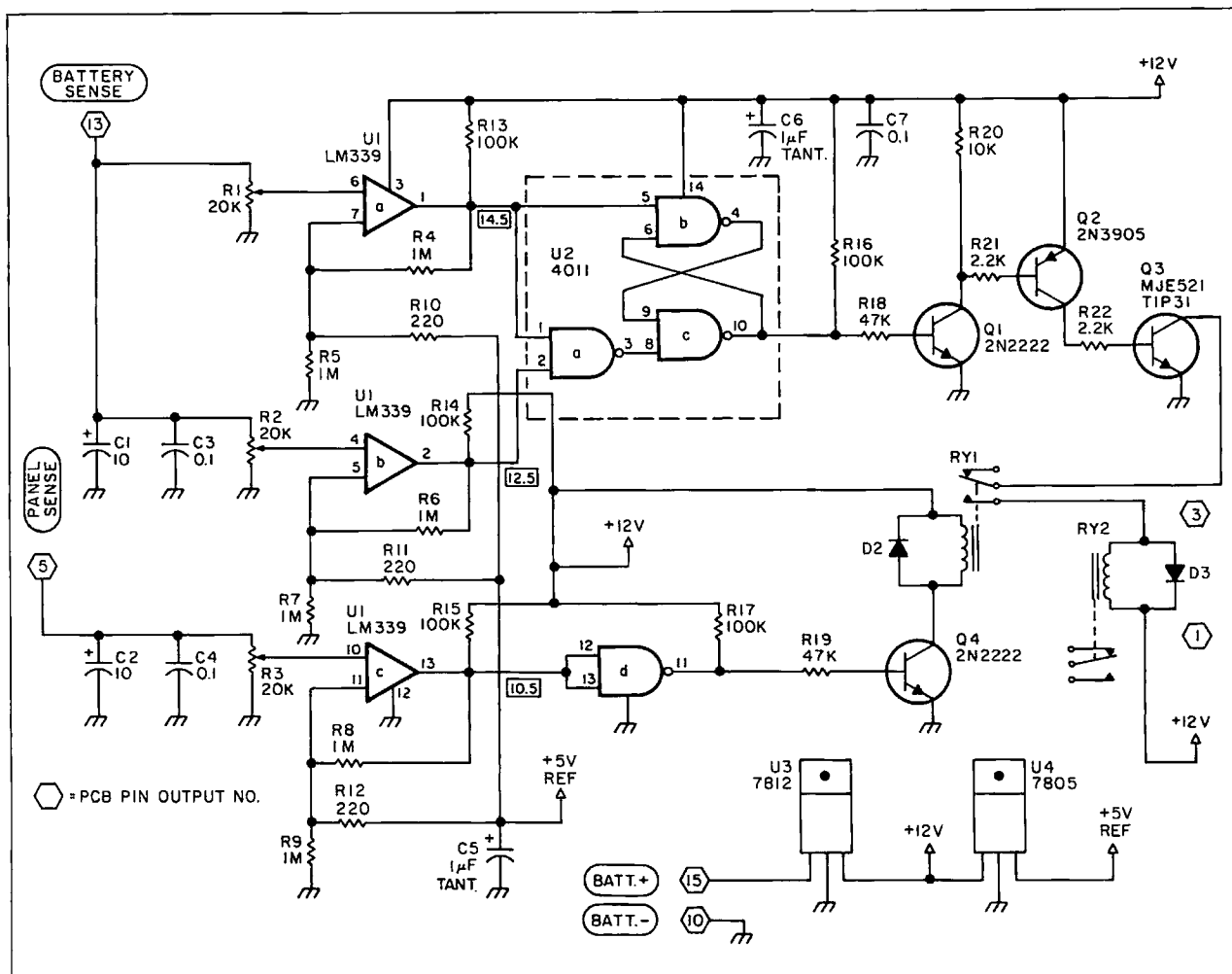


Figure 7. Schematic for the solar controller.

fit inside the box. It is a snug fit, but not binding. Make a metal bracket to hold the batteries in place so they won't shift around. I used a piece of angle steel stock for my bracket.

The output jacks on the outside of the box

are for DIGI, AUX OUT and PANEL IN. The DIGI jack is the power for the RADIO/TNC box and has a one amp fuse inline with its output. The AUX OUT jack is a parallel jack with the DIGI jack, with a 3 amp fuse inline. This AUX OUT jack can be

used to power any external unit, like a transceiver, another digipeater, etc. The PANEL IN jack is the solar panel input to the charge controller. You will see in the template drawing of the box (Figure 6) that I have placed two 5/16" holes near the bottom of the box. These are for the breather tubes coming from the batteries. Also, the "Charge" LED and power switch for the controller are mounted on the end

of the box.

Solar Charge Controller

The basic circuit for the controller uses three sections of an LM-339 voltage comparator IC (see Figure 7). Two sections are used to monitor the HIGH and LOW battery voltage, and the third section is used to monitor the voltage output from the solar panel. I found several articles dealing with solar charging in various publications, and by combining features of these articles I came up with my own simplified version. The project can be built on a printed circuit board available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for \$8 plus \$1.50 S & H.

Alignment of the circuit will require a variable power supply (+10-15V), a digital VOM and a logic probe. First, connect both the battery sense and panel sense input lines to the same point. Adjust the voltage output of the supply to 14.5 volts and place the logic probe on pin 1 of the 339. Adjust the 20k pot, R1, to where the probe goes LOW. Set the power supply to 10.5 volts and adjust R3 to where pin 13 goes LOW. Rock the supply to make sure all the set voltage points are set

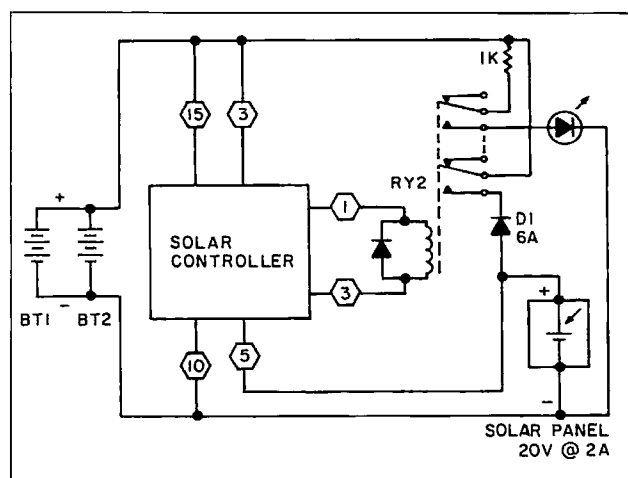
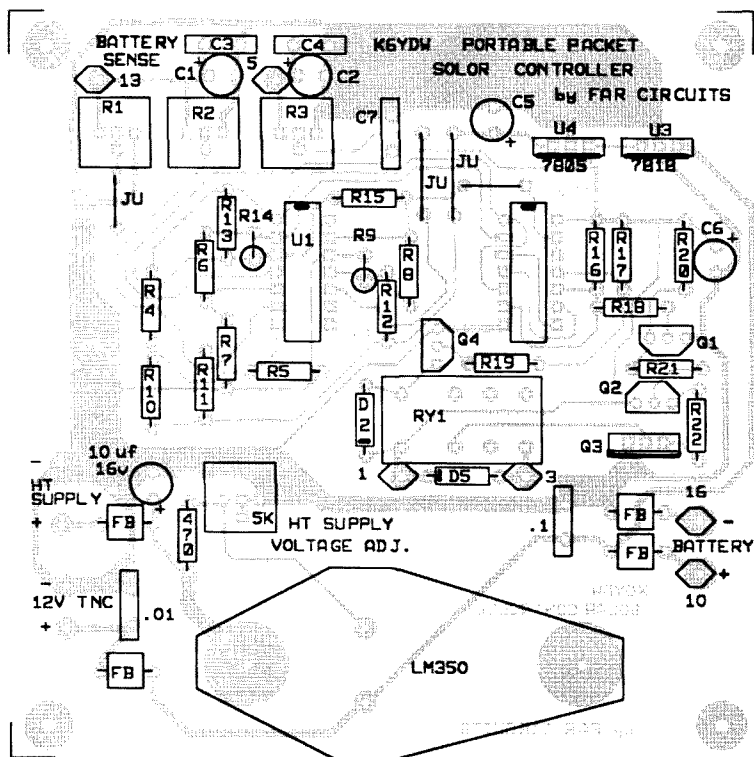
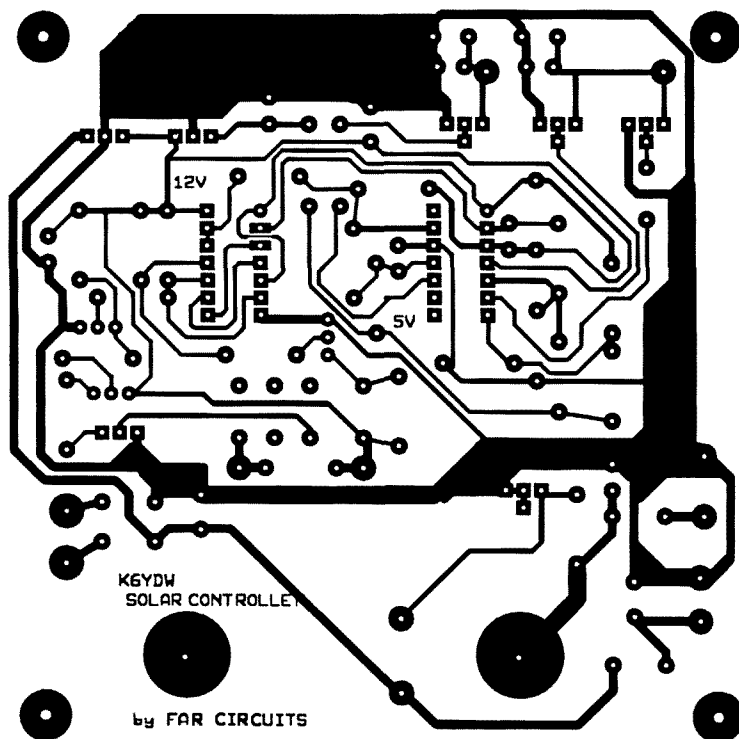


Figure 8. Solar controller external wiring.



correctly. The controller is now ready to be mounted in the box.

Attach the battery sense line to the positive battery post on the battery. Do not attach it to any other point. Then, attach the panel sense line to the output of the solar panel, making sure you have connected it on the anode side of the blocking diode, D1. The blocking diode is used so the panel sense circuit will not be fooled by the voltage output of the batteries. The 10.5 voltage sensor portion of the circuit is not required; it's just as an added feature. The charge circuit will work without it, but I use it as a "day-night" switch. See Figure 8.

Operation of the controller is fairly simple. As long as the panel sense voltage is above 10.5 volts the circuit is active. If the panel sense voltage falls below 10.5 volts, then RY1 is disabled, thereby preventing any charge voltage to the batteries. When the voltage from the solar panel rises to above 10.5 volts, RY1 is connected between the collector of Q3 and the coil of RY2, which allows any charge voltage from the solar panel to flow when requested by the controller circuit.

When the battery post voltage falls to 12.5 volts, pin 2 of the LM339 comparator goes LOW, thereby turning on RY2, allowing current to flow from the panel to the batteries for charging. When the battery post voltage reaches 14.5 volts, pin 1 of the 339 will go LOW, turning off RY2. The "float charge level" is 14.5 volts for most lead-acid batteries.

General Information

The total weight of both boxes is 33 pounds, fully loaded. This weight is a bit excessive, but you have a rugged and, for the most part, weatherproof unit that can be placed in any location desired, like under a large boulder, bush or tree, and it will provide signals to reach from your remote location to the next digipeater.

For an antenna I use a modified Hustler CG-144 5.8 dB mobile whip to which I have attached three radials. This antenna is then mounted on a 5-foot section of TV mast. Three other 5-foot sections are added to give a total height of 20 feet, which can be placed in the rocks or self-supported with some nylon rope. For coax, a good choice is RG-8/x mini-foam, as it is quite flexible and has good characteristics at this frequency. For the two-conductor cable between the two boxes, use a good quality cable which has a heavy outer sheath. I also use this type of cable between the box and the solar panel. For all power connections I use 4-pin micro-processor connectors. This type of connector provides screw mounting, which gives security in remote locations where other types of connectors could be pulled out by animals walking by. For this reason, do not use phono type connectors.

For extra weatherproofing protection, you can cover the boxes with a small tarp. This

Figure 9. PC board and parts placement.

will also shield the boxes from any direct sunlight. Also, turn both boxes to where the heat sinks are facing north, or are in the shade all the time.

The boxes should be painted with a good quality rust inhibitor paint. The bottom and the side on which the large heat sinks are mounted should be a flat black finish. Other areas should have a light-color finish to help reflect heat.

The dual-battery setup will provide plenty of backup power in case of poor voltage output from the solar panel due to clouds, smoke or haze. I have run a test using just the fully charged batteries alone, with no charger in the circuit. When I set the TNC to beacon one line of text every 10 seconds, and the HT to full power of 2.5 watts out, it ran for five days with only a half volt (0.5V) drop through the test period. There is no reason you cannot use just a single battery instead of two. The total package would be lighter by about 15 pounds.

Operation

The system should be set up before you transport it to a remote location. Plug your terminal into the RS-232 I/O port on the HT/TNC box, then apply power to the system by plugging in the power cable from the battery box.

The following parameters are for the TNC-2 type, for unattended digipeater service:

CONOK-OFF: DWAIT=0:
TXDELAY=50: DIGI=ON:
USERS=0: MON=OFF:
HID=ON

Unplug the power cord and disconnect the terminal. You are now ready to use this system when needed.

Whatever HT/TNC and battery combination you use, it will have to be a special design to fit your needs.

Parts List for Solar Controller

Integrated Circuit		
U1	LM339 voltage comparator	RS276-1712
U2	4011 CMOS quad two-input NAND gate	RS276-2411
U3	12 volt voltage regulator	RS276-1771
U4	5 volt voltage regulator	RS276-1770
Transistors		
Q1,Q4	General purpose NPN (2N2222, 2N3904, etc.)	
Q2	General purpose PNP (2N3905, etc.)	
Q3	TIP31 NPN	RS276-2017
Diodes		
D1	Silicone 50V at 6 amps (1N5400, etc.)	
D2,D3	1N4001	
Resistors		
R1,R2,R3	20 kilohm 15-turn trimmers	RS271-340
R4,R5,R6,R7,R8,R9	1 megohm 1/4 watt	
R10,R11,R12	220 ohm, 1/4 watt	
R13,R14,R15,R16,R17	100 kilohm, 1/4 watt	
R18,R19,R22	47 kilohm, 1/4 watt	
R20	10 kilohm, 1/4 watt	
R21	2.2 kilohm, 1/4 watt	
Capacitors		
C1,C2	10 µF, 35V electrolytic	
C3,C4,C7	0.1 µF, 50V disc	
C5,C6	1 µF, 35V electrolytic	
Relays		
RY1	12V DPDT (16-pin DIP)	RS275-249
RY2	12V DPDT (10 amp contacts)	
Batteries		
BT1,BT2	12V at 14 Ah motorcycle-type or gel-cel	

Circuit boards are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for \$8 plus \$1.50 S & H.

This article is intended as a simple guide. Any comments are welcomed, and a SASE will be appreciated for any return comments.

Acknowledgements:

"Captain Kirk's Lunch Box, Part 1," by Robert Hoover KA6HZF, *CTM Magazine*, August 1987, page 21.

"Captain Kirk's Lunch Box, Part 2," by

Robert Hoover KA6HZF, *CTM Magazine*, September 1987, page 28.

"Total Solar" by Michael Bryce WB8VGE, *73 Magazine*, May 1986, page 60.

"The Battery Topper," by Michael Bryce WB8VGE, *CTM Magazine*, June/July 1987, page 25.



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16 Tips For Using PCB Layout Software

You can do things differently when you design a PCB on your computer.

by Jim Tarchinski N8PTG

Fewer and fewer printed circuit boards (PCBs) are laid out by hand these days. The reason is simple: More and more hams are using computers to create the artwork for their boards.

There are many reasons for this trend away from hand-taped artwork, but there are two main ones. First, prices for PCB layout packages are only a fraction of what they were just a few years ago. In fact, there are even a few shareware programs floating around that allow you to lay out a board on your computer (see the sidebar). Prices are definitely in a range that is affordable to most casual PCB creators.

The second reason layout programs are becoming so popular is that they can shorten the time it takes to design a board from scratch. This is especially true if the software can automatically route the traces, or check your traces against a network connection list (netlist) generated by a schematic drawing program.

Like any other change, however, going from hand-taped to computer-created artwork requires you to change your thinking somewhat. There are some things that can be done, or even should be done, differently. I've learned a few tricks in the year or so that I've been using a layout program, so I'd like to share some of them with you. This article offers 16 tips to help you make

a smooth transition to creating computer-based PCB layouts.

Tip #1

Before you even begin to lay out a board, give some thought to how it will eventually be mounted. If you bought an enclosure at the last swap meet that will work perfectly, you'll need to consider this up-front. This could influence your selection of components or your decision on the layout.

Tip #2

Except for the tip I just mentioned, don't decide on a board size until you make an initial layout and get a rough idea of how much board area is required. Once you have a good handle on this, be sure to select either a standard PCB size or the size of a remnant you have on hand. After all, why cut a larger board down to size if you don't have to?

Tip #3

Don't choose a double-sided board unless you're forced into it. Start by running traces on the solder side only. If you run into too many intersecting traces you can always switch to a two-sided board. It's often surprising how many traces will fit on only one side, especially if your layout program has an excellent "auto-route" algorithm. It's

also worth remembering that jumper wires can frequently get you out of a bind on a single-sided board (and even on some double-sided ones!).

Tip #4

When possible, place mounting holes at half-inch increments from one another. Then, when you go to drill the mounting holes in the project case, you'll find that it's much easier to mark off half-inch distances than an odd number of 0.1-inch increments, the step size that most programs use.

Tip #5

For dual-sided boards, be sure to write "Solder Side" and "Component Side" right on the layout. This will help you later on when you have to determine the orientation of the clear artwork against the board. See Figure 1.

Tip #6

It's also a good idea to write the date and a version number right on the artwork—preferably on both sides of the board. This helps you keep track of multiple versions of the same project. I got hit by this once, and it took me nearly an hour to figure out that I had accidentally used an old version of my artwork on the bottom side of the board! See Figure 2.

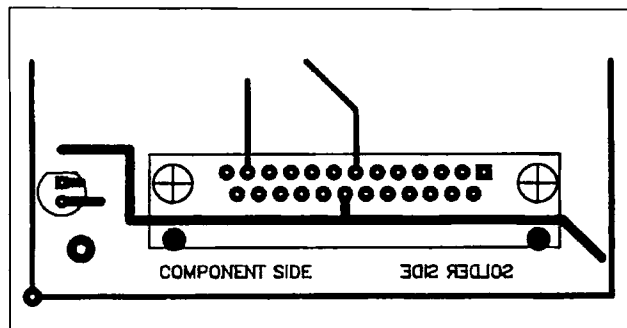


Figure 1. Tip #5.

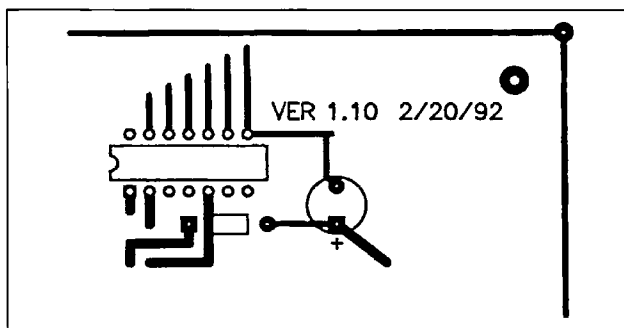


Figure 2. Tip #6.

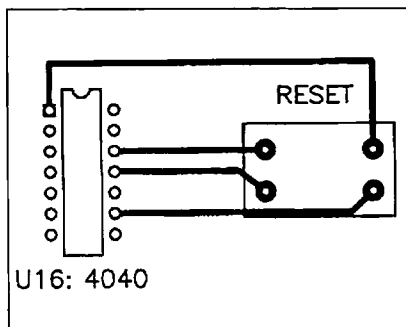


Figure 3. Tip #7.

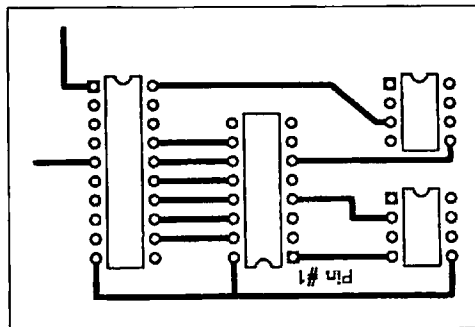


Figure 4. Tip #8.

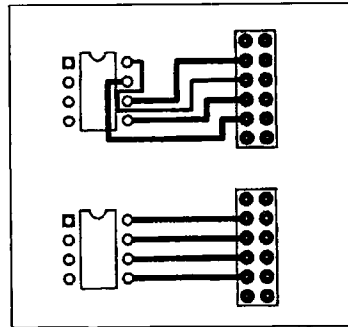


Figure 5. Tip #9.

Tip #7

Most hams don't place a silk-screen layer on their boards. In its place, consider putting important information right on either the top or bottom copper layers. If you have the room, component names and/or values are often convenient to have right on the board. See Figure 3.

Tip #8

Try to mount all IC packages in the same direction, unless this violates one of the other rules mentioned above. If you are forced to mount one IC "upside-down," be sure to clearly mark pin #1 on both sides of the board (Tip #7). See Figure 4.

Tip #9

Change the schematic whenever it helps! It's amazing how many people seem to think a schematic is set in stone when they get to the layout phase of a project. If you can redefine connector pin numbers, or use one IC gate in place of another, it frequently simplifies the board layout. Just be sure you go back and update to print so you'll remember that you made the change later on.

Although I don't recommend it, some people tend to take this tip to an extreme—they actually lay out the board *before* they draw the schematic. See Figure 5.

Tip #10

Now here's one that is really simple, but again, it's surprising how many people never seem to think of it. Remember that all pads do not have to be the same size, not even all the pads for a single component. If you need extra room (to lay a high current

trace, for example) make some of the pads smaller. This is especially true for unused pads, which you may even be able to eliminate completely. See Figure 6.

Tip #11

Several times during the design, print out an exact-size copy of the layout, being sure to include the silk-screen layers even if you won't be using them. Place the actual components on this printout to make certain there's adequate space for everything. Pay particular attention to large capacitors, mounting holes for connectors, and any components whose templates you created yourself.

Also, be sure connector pin numbers line up correctly.

If you designed for a male DB25 connector, but the layout software put down a female DB25, your pin definitions are not going to be what you expect.

Tip #12

Place extra pads on unused connector pins or IC gates. You may not have a need for them later, but if your initial design doesn't work, they will make it much easier to modify the board further down the line. You may even want to include pads or component space for any "upgrades" that you might want to wire in later. See Figure 7.

Tip #13

If you don't use through-plated holes (as is the case with most hams), make certain that all the traces you run on the top layer can be soldered to the components on the top layer. For example, straight PCB-mounted connectors are frequently encased

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Shareware

(Most programs are available on electronics-oriented BBS systems across the country.)

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in plastic in such a way that you can only solder them to the bottom side of the board—the top side of the pins are completely blocked off.

If this causes you a problem, there are two things you might try: Either mount them to a component a few millimeters above the board so you can get an iron in there, or use a via (through-hole) near the

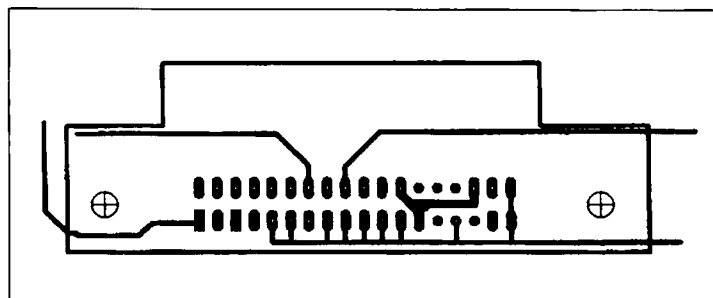


Figure 6. Tip #10.

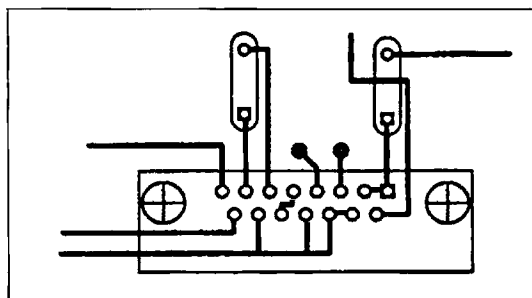


Figure 7. Tip #12.

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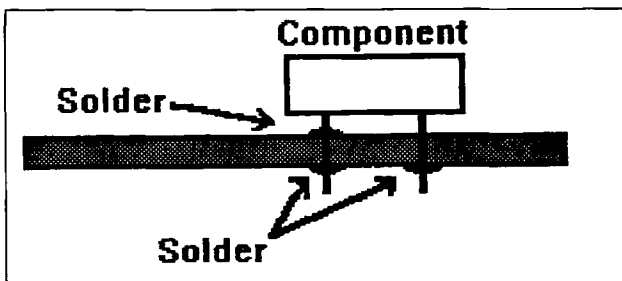


Figure 8. Tip #13.

problem pad. See Figure 8.

Tip #14

Once again, for those who don't use through-plated holes, keep vias to a minimum. You'll have to solder through every via that you design in, which is a pain in the neck. This is another handicap you may find with most auto routing routines, which tend to use vias like they're going out of style.

Tip #15

Consider creating your own personalized checklist of things you want to examine before you're finished with a layout. Before I came up with my list I

frequently forgot to size my mounting holes correctly, or to run an automatic check to verify all my trace routings.

Tip #16

Don't throw away all the "good old" design rules that you used when you laid out PCBs by hand. For example, you still should keep the analog and digital sections separated, be sure to use grounding planes where necessary, and don't make the traces too small for the expected maximum current load. Most software just isn't smart enough yet to check for stuff like this (but the way things are moving, it's only a matter of time!).

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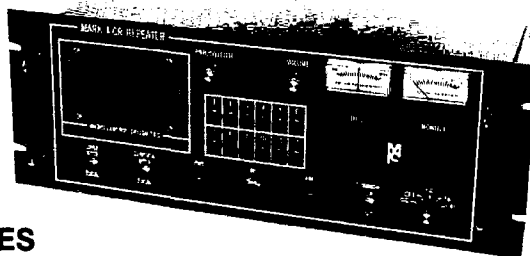


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Building and Using N7APE's NiCd Zapper

An update.

by Marion D. Kitchens K4GOK

In the September 1992 issue of *73 Amateur Radio Today*, Ed Miller N7APE described a circuit for recovering NiCd batteries that have grown internal shorts. His article got my immediate attention because it seemed like a simple solution to a problem that plagues many of us. Most of us have numbers of just such NiCds. If you do much with NiCd batteries around the ham shack, then you will definitely want to build N7APE's circuit. Some hams have been known to burn out internal NiCd shorts by momentarily connecting them to an automobile battery. This can be dangerous, and is not recommended. N7APE's circuit can eliminate that danger and still recover the shorted NiCds. Furthermore, after clearing the short, the circuit will automatically switch into the charge mode and recharge the battery. A pretty neat circuit!

This article describes the experiences of two builders of N7APE's circuit, and relays the experience and knowledge they gained about recovering NiCds.

Building The Circuit

Gene WØDLQ and I both built "Zappers" according to N7APE's article. The original publication contained one error in the schematic: The correct value of R5 should be 560k, as per the parts list, and not the 560 ohm value shown on the schematic. More on optimizing the value of this resistor later. The unit shown in the photographs used an under-the-bench power supply (12 volt auto battery on a charger), while WØDLQ used a built-in AC power supply delivering about 17 VDC to the circuit. The unmarked diodes in the original publication are 1N914 or similar.

Being experimenters, both of us made minor changes in N7APE's circuit. First, as an operating convenience, a "reset" switch was added to discharge an internal cap (C7) so the unit could be easily reinitialized after recovering a NiCd. Second, some voltage dividers and sensing circuits were modified to allow use of different supply voltages. Third, a fixed voltage regulator chip was used in place of the LM317 regulator. My unit used an active LM317 current-limiting regulator in place of resistor current limiters. If the

LM317 current limiter is used, it requires a 1" x 2" heat sink. If you use the fixed resistor(s) at R1, they should be rated for 2 watts.

Gene and I could not resist adding a "zapping" LED to indicate that this function was happening. You have clear indications of the zap/charge mode via the red/green LEDs. We also added a switch to allow selection of 50 mA for charging AA size NiCds, or 100 mA for charging C or D size NiCds. The changes made in our circuits are shown in Figures 1 and 2.

Checkout and Adjustments

Several adjustments need to be made after assembly. The sequence of checks and adjustments shown in the sidebar is recommended. This list provides a sequence that allows for easy resolution of problems, should they occur. Note that it is easy to get the circuit "locked up" in the charge mode, so follow the checkout instructions carefully! You can "unlock" the circuit by pushing the "reset" switch.

Adjusting R13 for about 0.500 volts on

pin 6 seemed to help in recovering some of the very old NiCds. N7APE recommended about 0.300 volts, which should be fine for most users.

After getting the unit operating, optimization of the circuit is recommended. Optimization will result in the circuit delivering the maximum available energy to burn out the internal short, thus reducing the time necessary to recover a NiCd. The best method of optimization will depend on the resistor values and supply voltage in your particular unit. Try the easy way first.

The Easy Way

Short pin 5 of the IC to ground, and short across the battery box for the following operations. Adjust R10 for maximum voltage on pin 2 of the IC. Measure and record that voltage. This may cause the voltage on C1/C2 to increase and stabilize at the supply voltage. Check with a voltmeter. If the voltage is steady, you can optimize the unit the easy way. (If the voltage ramps up and down, you'll have to do it a slightly harder



Photo A. K4GOK's NiCd Zapper.

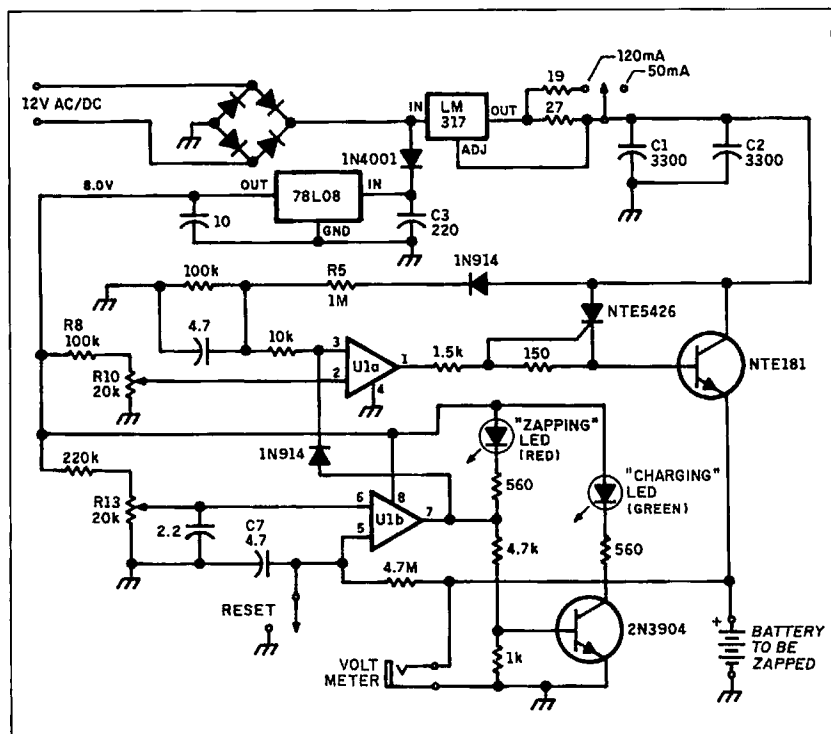


Figure 1. NiCd restorer from N7APE, as modified by K4GOK.

way, described below.) Once the voltage on C1/C2 is stable, measure and record the voltage on pin 3 of the IC; it should be less than that on pin 2. The voltage on pin 1 should be less than 1 volt. Next, adjust R10 until pin 3's voltage is just slightly less than that on pin 2. At this point, the voltage on pin 1 should be pulsing with very short pulses, and the voltage on C1/C2 should be ramping up and down.

The Harder Way

If adjusting R10 for maximum voltage on pin 2 does not stop the voltage ramping up and down on C1/C2, you'll want to make some changes in resistor values. The idea is to change either R5 or R8/R10 until you can get the ramping up and down to stop. In my unit I increased the value of R5 to 1.2 megohms, while Gene made R10 a 100k pot and replaced R8 with a jumper soldered permanently in place. The changes required will depend primarily on the supply voltage you use. In general, the higher your supply voltage, the larger the value needed at R5 or the smaller the resistor needed at R8. Make changes until you can get the voltage on C1/C2 to come up to the supply voltage and stabilize (no pulsing or ramping up and down) by setting R10 to maximum voltage at pin 2. Then adjust R10 as described above so the voltage on pin 3 is just slightly less than that on pin 2.

Check that the voltage on C1/C2 now ramps up and down. The unit will deliver the maximum energy to zap the NiCd when adjusted as described above. Remove the jumpers from pin 5 to ground and from

across the battery box. Now you are ready to put the zapper to use.

Zapping Some NiCds

Using the zapper is very easy. Put in the bad NiCd and turn on the power. The

"charging" LED will flash very briefly and the "zapping" LED will come on. If the power is already on when the NiCd is inserted, or if a recovered NiCd has just been removed, you will have to push the reset switch to reinitialize the circuit. The "zapping" LED stays on until the short is burned out. Then the zapper automatically switches to the charge mode and the "charging" LED comes on. Leave the NiCd in the zapper for the recommended charge time, or remove it and place it in a standard charger.

We had 16 very old NiCds on hand for learning to use the zapper. Eight of these were more than 20 years old, a good set to see just what the zapper would really do. All of these NiCds measured 0.000 volts, and obviously had internal shorts. We tried all eight NiCds for an hour or so without any signs of recovery. Additionally, we zapped all of them with the automobile battery technique, without success. The automobile battery technique had never failed before—it puts quite a large jolt of current through the cells. These NiCds were more than dead!

Finally, a NiCd was left overnight on the zapper, and the "charging" LED was "on" the following morning. Eventually, four of these eight NiCds were recovered by overnight treatment with the zapper. Let the zapper do its job, and don't give up on the NiCds too soon. Four of them never recovered, even after 24 hours on the zapper. We set those aside.

All eight of the remaining NiCds were recovered. These were not as old as the eight described above, but they were 10 or more years old, and unkept for most of that time. These recovered in varying time. Some in a

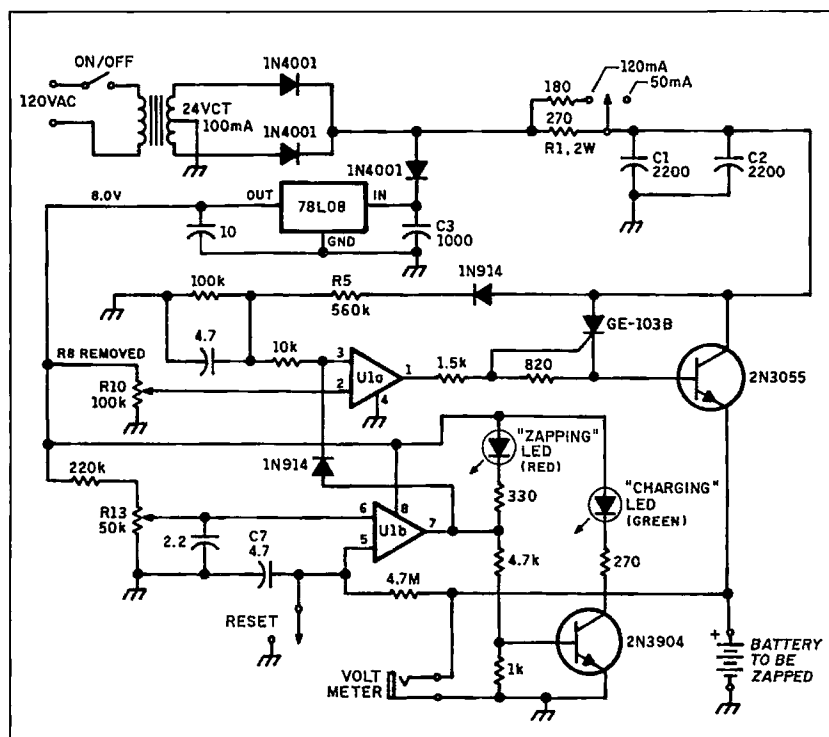


Figure 2. NiCd restorer from N7APE, as modified by WØDLQ.

matter of an hour or so, and a few required four or five hours to recover.

After recovery and charging, a number of the NiCds regrew their internal short. Some regrew the shorts while on a charger, unexpectedly. A short treatment on the zapper recovered these again, usually in minutes, instead of the overnight or several hours as initially required. All of those NiCds that initially regrew their internal shorts did so repeatedly. As they were re-zapped, it required less and less zapping time each cycle. It appears that with enough runs through the zapper they all might be fully recovered to hold a charge, although this has not been confirmed as of the writing of this article.

Several of the recovered NiCds displayed symptoms suggesting they had internal discharge paths, as opposed to internal shorts. This result exhibited itself when a zapped battery would recover in half an hour or less and would accept a charge, but would discharge to a low (not zero) voltage in less than 24 hours. About half to two-thirds of the 20+-year-old batteries had these symptoms.

More recently purchased NiCds (four to five years old) recovered nicely. I had only three NiCds in this category. They all recovered quickly and would hold a charge. No energy storage capacity test of these NiCds was done.

In recovery of old, shorted NiCds be wary of those that show unusually high or low voltages after charging. Experience suggested that those with fully charged voltages of more than 1.45 or less than 1.15 volts would eventually be "bad actors." They would either revert to internal shorts quickly, or would refuse to hold a charge for any significant time.

Note that the zapper will revert to the zapping mode if the NiCd voltage drops below the trip voltage set on pin 6. This allows you to leave a recovered NiCd in the zapper, and should it regrow its internal short while being charged, the zapper will automatically switch back to the zapping mode and re-zap the NiCd. This was observed a number of times on the 20+-year-old NiCds. This feature of N7APE's circuit was not recognized until it was experienced in practice. A nice feature indeed.

Conclusions

The N7APE designed circuit works and works well. It does indeed recover internally shorted NiCds in a safe and effective manner. N7APE did the ham community a fine service in designing the zapper circuit. NiCds as old as some investigated here could not be permanently recovered. However, those NiCds of more recent vintage were successfully recovered. Any ham who uses NiCds should construct this device and put it to use.

Acknowledgments: Thanks to my friend

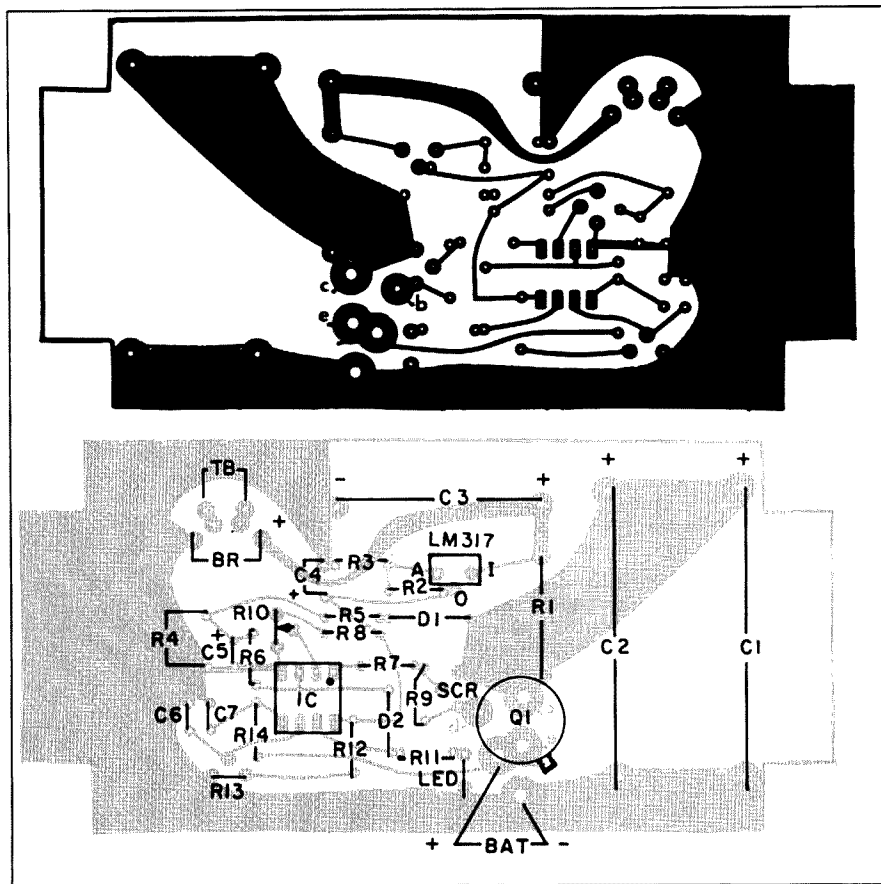


Figure 3. PC board pattern and parts placement diagram for the NiCd Zapper.

Checkout Sequence

1. Remove all power from the unit.
2. Discharge C1/C2, C4, C5, C6, and C7 completely by temporarily shorting them to ground.
3. Remove the LM358 IC from its socket.
4. Put a shorting jumper wire across C1/C2 to ground, and leave it there until step 10 below.
5. Turn on power and verify that the voltage at the regulator output is correct.
6. Verify that the voltage across C3 is at least 2 volts higher than the regulator output voltage. If not, the supply voltage must be increased, or the value of R1 must be increased.
7. Measure the voltage across R1 (same as across C3) and calculate the current through R1. This current needs to be 50 mA for charging AA cells and 100-120 mA for charging C and D cells. If it is not correct, either the supply voltage or the value of R1 must be changed. The conditions of #6 above must still be met after any changes here.
8. Verify that pin 4 is at ground potential, and that pin 8 is at the regulator output voltage.
9. Adjust R13 for about 0.3 to 0.5 volts on pin 6, and set R10 to its midrange.
10. Turn off the power and remove the jumper from across C1/C2.
11. Discharge the capacitors as described in 1 and 2 above.
12. Put a shorting jumper across the battery box. Insert the LM358 IC in its socket, and apply power.
13. The "charging" LED may flash very briefly, and the "zapping" LED should come on.
14. Connect a voltmeter across C1/C2 and adjust R10 for the maximum voltage on pin 2 that still lets the C1/C2 voltage ramp up and down, as seen on the voltmeter.
15. Remove the jumper at the battery box. After about five seconds the "zapping" LED should go off and the "charging" LED should come on.
16. Push the "reset" button. The "zapping" LED should come on immediately, and after about five seconds should go off and the "charging" LED should come on.
17. Re-connect the shorting jumper at the battery box. The "charging" LED should stay on for five to 10 minutes, or until the "reset" button is pushed.
18. See the text for information about optimizing the zapping energy.

NOTE: It is safe to verify the battery charge current via a mA meter at the battery box as long as the "charging" LED is on. But do NOT try to measure the current when the "zapping" LED is on!

Gene WØDLQ for building a zapper as I was building mine, and for numerous exchanges of ideas, comments, and discussions. Without his involvement it is unlikely I would have tackled this fun and useful project. And, of course, many thanks to N7APE for designing and publishing the circuit!

[Ed. Note: Reprints of the original article, "NiCd Restorer/Charger" by Ed C. Miller N7APE, are available for \$3 each from 73 Amateur Radio Today, 70 Route 202 North, Peterborough NH 03458. Circuit boards for the original project are available for \$5 plus \$1.50 S&H from FAR Circuits, 18N640 Field Court, Dundee IL 60118.]

Backup Battery Monitor/Charger/Alarm

Be prepared for emergencies.

by J. Frank Brumbaugh KB4ZGC

The well-equipped ham station has one or more deep-cycle storage batteries to provide operating voltage during interruptions of commercial AC power. Battery backup is invaluable during emergencies, natural or man-made, and allows operation when commercial power outages are local in nature—when wind, ice or other elements down power lines, affecting small areas.

Storage batteries require care and must be maintained at full charge so they will be available immediately when needed. While delivering power to operate modern 100

watt solid-state transceivers, storage batteries must not be discharged by more than 60% of their ampere-hour capacity or they may be damaged. Replacing deep-cycle storage batteries can be an expensive proposition.

Because modern solid-state 100 watt transceivers draw about 20 amps keydown, at even the 33 to 50 percent duty cycle of SSB or CW this will limit emergency operation to 10 to 20 hours maximum if 100 Ah batteries are used. Normal operation is considered to be 10 percent transmit and 90 percent receive.

These transceivers often will not function properly at low voltage, and storage batteries can be damaged if discharged too deeply, so it is advantageous to be able to tell the state of charge of batteries at a glance instead of having to check the specific gravity of each cell with a hydrometer. Also, a visual or audible alarm to warn when the battery has been discharged by 60 percent—only 40 percent charge remaining—alerts the operator to cease operation or risk permanent damage to expensive deep-cycle storage batteries.

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scribed in this article will:

- Monitor the state of charge of station backup batteries.
- Maintain batteries at full charge, preventing overcharging.
- Provide a visual and/or aural alarm that warns of low battery voltage.
- Indicate voltage and current supplied to the transceiver.

The Circuit

See Figure 1. This project includes a voltage-limited regulated power supply operated from the AC line and provides up to 3 amperes to maintain the batteries at full charge. Charging voltage is constant at the normal full-charge level, so the charging current drops as full charge is approached, and full charge is maintained with a trickle current. This charging voltage can be adjusted between approximately 10 and 15 VDC to accommodate lead-acid (13.8V) or lead calcium (13.2V, 13.5V maximum) deep-cycle storage batteries.

A separate connection is provided so an external charger can be used when greater than 3 amperes is needed to charge a partially discharged battery. Any standard automobile battery charger can be used, setting the charging current at no more than 10 percent of the ampere-hour capacity of

Table 1. Battery Condition Meter Calibration

Lead-Acid Battery		Lead Calcium Battery	
Color	Voltage	Color	Voltage
Red	11.6 and below	Red	11.6 and below
Yellow	11.6-12.0	Yellow	11.6-12.0
Green	12.0-13.8	Green	12.0-13.5
Red	13.8 and higher	Red	13.5 and higher

the battery. Internal circuitry will maintain the charging voltage to the battery at the nominal full-charge voltage level, regardless of the voltage supplied by the external charger, which will be 2 volts or more greater than that applied by the regulator to the storage battery. **WARNING: Do not fast-charge deep-cycle storage batteries!**

A pair of meters calibrated to indicate 20 VDC and 20 ADC full-scale monitor voltage and current provided to the rig when battery power is used.

A separate, suppressed zero, expanded-scale meter calibrated over the range of about 10 to 15 VDC allows immediate and constant indication of the state of charge of the station's backup battery. This meter scale is calibrated in bands of red, yellow and green, as explained in Table 1. The narrow yellow segment is based on the as-

sumption that solid-state transceivers may not operate properly below +12 VDC. The internal power supply is used to calibrate this meter. A DMM should be used for greatest accuracy. Colored markers can be used to produce the multicolored scale.

An alarm circuit is included to indicate when the battery has been discharged by 60 percent to the 11.6 VDC level. When battery voltage is above 11.6, the green

LED will be illuminated; when voltage falls to 11.6, the green LED goes out and the red LED lights. A piezo audible alarm sounds at this low voltage level unless silenced by the toggle switch controlling it.

A pair of fixed three-terminal regulators are included to provide +9 and +6 VDC for station accessories with outputs terminated in RCA jacks. An additional RCA jack provides regulated voltage from either the internal AC supply or the storage battery for accessories requiring this voltage.

Most small 12 volt relays have a coil resistance of 100-300 ohms and require 50 to 150 mA for operation. Because this current must flow through switch transistor Q4, the power dissipated is much higher than can be handled by any of the small signal transistors usually available (2N3904, etc.). Although at first glance it may seem

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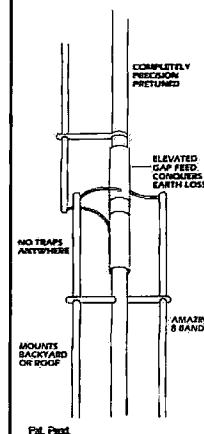


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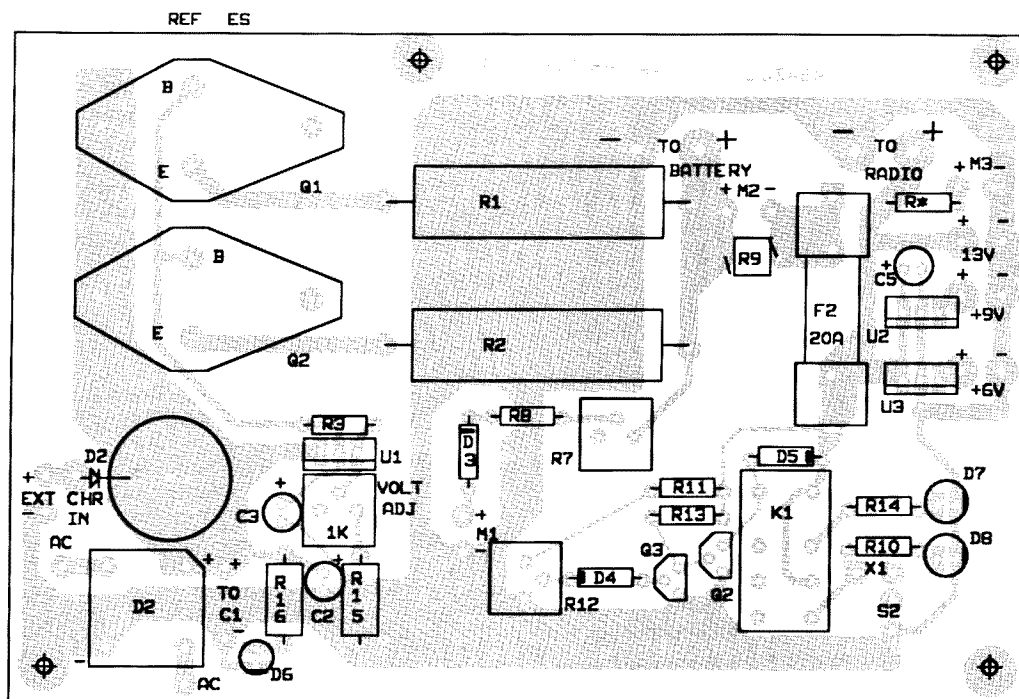
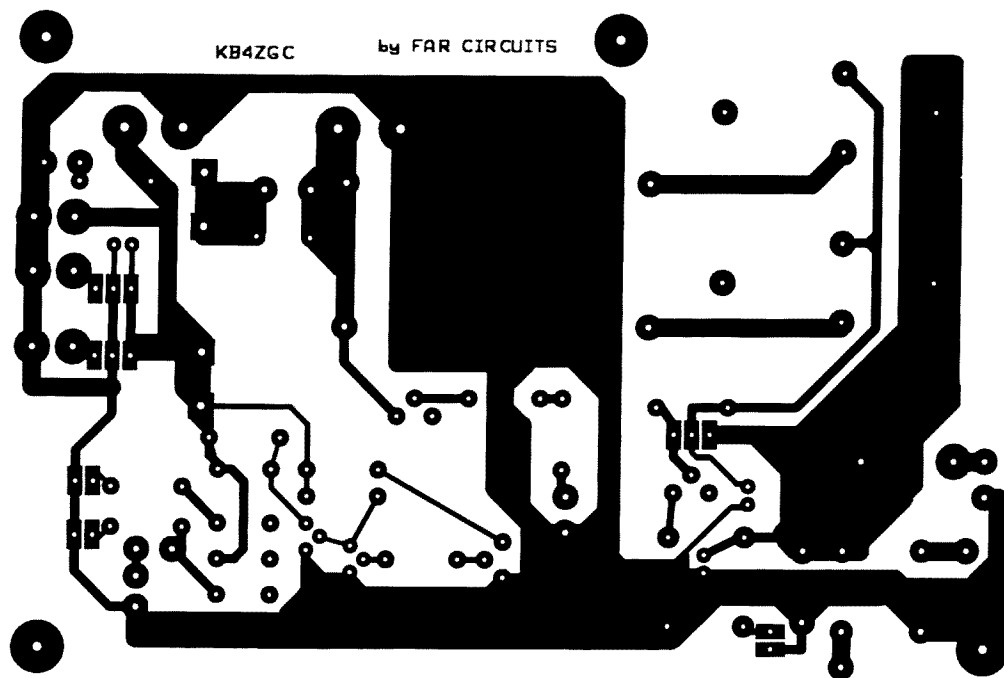


Figure 2. Circuit board and parts placement for the Backup Battery Monitor/Charger/Alarm. Note: If transistors Q1 and Q2 are mounted on the PC board, they must be heat-sinked. The transistors may be external to the board and wired back to the PC board.

charged to above fully charged condition of the storage battery is expanded over the full scale of the battery condition meter M1, making voltage (and charge level when calibrated) changes much easier to see.

The resistance of the meter multiplier I used was based on the 265 μ A full scale deflection of the small surplus meter I

used. Depending upon the full-scale current of your meter, the multiplier resistance can be determined, as explained above, for 5 VDC full-scale indication.

Final Adjustment

Apply AC power and set output voltage at 11.6 VDC, using a DMM for accuracy. Adjust R12 so the green LED D7 just ex-

tinguishes and the red LED D8 is illuminated. Operate S2 to check operation of the piezo aural alarm.

Increase output voltage to 13.8 VDC (lead-acid battery) or 13.5 VDC (lead calcium battery). Note that as output voltage is increased, the red LED D8 extinguishes and the green LED is illuminated. Now remove the power.

Parts List

C1	15,000 μ F, 50V electrolytic
C2	15 μ F 50V tantalum
C3, C5	22 μ F 15V tantalum
C4	0.01 μ F disc ceramic
C6, C7, 8	0.1 μ F 16V disc ceramic
D1	6A bridge rectifier
D2	20 ampere stud diode
D3	10V zener diode
D4	6.2V zener diode
D5	1N914, 1N4148, etc.
D6, 7	Green LED
D8	Red LED
F1	1 amp fuse
F2	20 amp fuse
J1, J2	2-terminal barrier strip, 25 ampere capacity
J3, J4	Binding posts, red and black
J5, J6, J7	RCA jacks (optional)
J8	Insulated terminal post
K1	12-VDC relay, SPDT
M1	Surplus meter, 200 μ A to 1 mA
M2, J3	0-1 mA DC meters
Q1, Q2, J2	2N3055 (on large heat sinks)
Q3	NPN small signal transistor (2N3904, 2N4124, 2N2222, etc.)
Q4	NPN 2N3053 (see text)
R1, R2	0.1 ohm, 5W
R3	240 ohm, 1/4W, 5%
R4	1,000 ohm pot, screwdriver adjust
R5, R6, R10, R14	1000 ohm 1/4W 5%
R7, 12	10k ohm trimpot
R8	15k ohm 1/4W 5%
R9	20 ampere shunt (see text)
R11, R13	1,000 ohm 1/4W 5%
R15, R16	1,000 ohm 1/2W 5%
S1, R2	SPST toggle or slide switch
T1	18-25 VAC secondary, 3A transformer
U1	LM317-T adjustable regulator
U2	7809 regulator (9 VDC) 1 amp
U3	7806 regulator (6 VDC) 1 amp
X1	Piezo alarm buzzer, 12-VDC

Pre-etched and drilled circuit boards are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118, for \$9.50 plus \$1.50 S & H.

Connect J1 to the battery positive terminal and J2 to the battery negative. Also connect J2, or the negative terminal of the battery, to the station DC ground. Note the indication on the battery condition meter (M1)—it should be in the green area above 12 VDC. Apply power while watching ammeter M2. If 3A or less are indicated, the battery can be left on trickle charge.

If the battery condition meter M1 indicates low in the green or yellow area, do not apply power or you may blow the primary fuse or overheat the transformer. Instead, connect the positive lead of an external battery charger of the type used to charge automobile storage batteries to J8 and the negative terminal to the negative terminal of the storage battery. Set the charger for an indication on ammeter M2 of not greater than 10 percent of the battery's ampere-hour capacity—10A for a 100 Ah battery, for instance.

Note that the voltmeter M3 and the battery condition meter M1 indicate full charge for the type battery you are charging, and that D7 is illuminated.

Ignore the indication on the battery charger voltmeter if one is provided. It will indicate somewhat higher voltage than is required for a fully-charged battery, but the internal regulator in this equipment will hold the voltage applied to the battery to the proper level and will not allow the battery to be overcharged. Charging current will gradually be reduced as the battery accepts the charge, eventually tapering off to a trickle: under 1 ampere. At this time, or at any time thereafter, the external charger can be disconnected and the power applied to this equipment and it will then maintain the battery fully charged for use whenever needed.

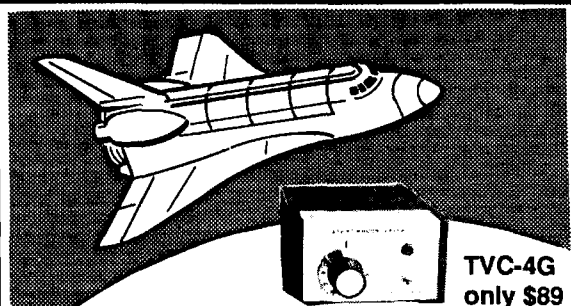
Conclusion

The large-capacity deep-discharge storage battery used for backup power in the station represents a sizable investment. When properly maintained and used, it will provide satisfactory service for many years. Building and using this simple equipment will ensure that power will be available when needed. With the battery fully charged and connected to this equipment, which should be powered from the AC line and turned on at all times, no further attention is required.

However, as with any storage battery in backup service, monthly hydrometer readings should be taken of each cell and recorded, in accordance with the battery manufacturer's instructions. Water which may be evaporated from the battery over time should be replaced when necessary with *only distilled water*, available in numerous supermarkets and drug stores throughout the country.

WARNING: Do not use tap water or any bottled water except distilled water or the battery may be damaged or its capacity to hold a charge reduced.

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Over the past two years I have reviewed MFJ's SWR analyzers as they progressed through the evolution process. The first version required the use of an HF receiver for accurate frequency setting (or the use of a portable frequency counter). The next version included a built-in frequency counter that displayed the frequency as you tuned for lowest SWR. Both units were designed for operation in the HF area of 1.8 through 30 MHz.

The most recent MFJ SWR analyzer brings VHF capabilities. The MFJ-249 HF/VHF SWR Analyzer covers all frequencies from 1.8 through 170 MHz. If this device doesn't become one of the handiest helping hands around the shack I don't know what will.

What is an SWR Analyzer?

An antenna analyzer is used to accurately determine the SWR of an antenna at the shack feedline, antenna, tuner, or any point in between. No transmitted signal is required during measurements. This means no on-the-air tune-ups, something most of us wish would go away anyway. Adjustments to the antenna can be made while the unit is hooked up to the antenna, thereby giving instant results of adjustments.

Measurements are made by use of a variable frequency oscillator, an SWR measuring circuit, and a digital frequency display.

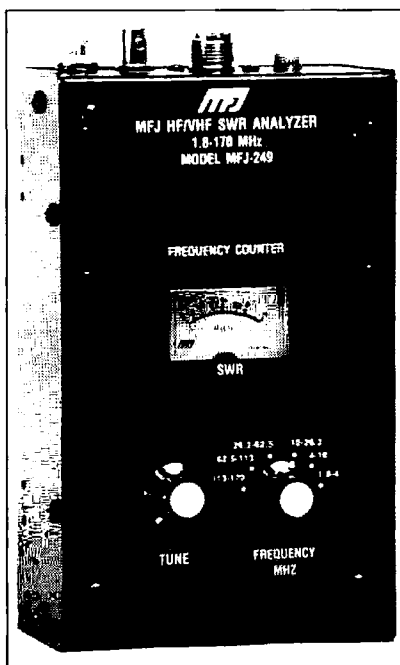
Advantages of a Small Unit

The MFJ-249 is completely portable for use in the field or in the shack (it operates on six AA batteries or an external AC supply). It can easily be used at ground level for verticals, on a tower for a directional antenna, and at any other antenna's feed point. Antenna SWR can be checked without returning to the shack.

In the shack, the SWR of your feedlines can be checked. After all, this is the SWR your transceiver will operate into.

Using the MFJ-249

First and foremost, read the manual before you use the analyzer. Although it is quite simple to operate, the analyzer can be damaged by improper use. The manual is



small, but it points out proper procedures that will assure correct usage. Probably the most important warning the manual gives is: DO NOT TRANSMIT INTO OR THROUGH THE ANALYZER.

The manual includes some general information about coax feedline losses and explains how high SWR increases these losses. It recommends further reading in the *ARRL Antenna Book*.

A sample SWR antenna plot chart is included, which can be copied for your use. Graph paper (my personal choice is 1/4-inch scale) works well for plotting, also.

In the Shack

I connected the analyzer to the various feedlines in my shack and tested each for the frequency of lowest SWR. I then made a record of this information for future reference. I also checked this newest set of readings with those of a year ago. All was still in order.

As a matter of curiosity, I now know why one of my 2 meter antennas has never

worked very well. The lowest SWR point is at 142.205 MHz and, unfortunately, the antenna is a sealed unit and not adjustable. Without the VHF capability of the new unit I could not have easily determined this.

I made a plot of the Cushcraft R5 (new last summer) and confirmed that no changes had occurred since installation. Interestingly, however, I found a large number of low SWR points between 60 and 115 MHz.

A couple of 2 meter HT antennas were checked and found to have SWR low points a little above the band. I have tried this test via other means in the past and observed similar results. It's interesting to watch the effect caused by objects in close proximity to these little antennas. When I waved my hand within a few inches of them the SWR would change from 1.2:1 to off the scale.

Have a feedline in the shack and not sure what it does? Just connect the analyzer and see where it operates.

Building and Adjusting a 75 Meter Dipole

The scenario for building a dipole antenna and using the analyzer for adjustments is quite simple. Using the formula $468/\text{frequency in MHz}$, a leg length of 60 feet each is determined. Note that few antennas will be exactly formula length, due to the environment in which they operate (i.e. proximity to power lines, other antennas, buildings, aluminum siding, etc.). For this example, the dipole legs are cut to 64 feet each (somewhat oversize, for adjustment purposes). Assemble the antenna using a center insulator as a feed point and haul it into place with a feedline attached.

Connect the analyzer to the feedline and check for the frequency of lowest SWR. In this case it is 3.585 MHz. As the antenna is meant to operate at about 3.9 MHz, some leg pruning will be necessary.

Leaving the analyzer connected, drop the antenna and prune 6 inches (12 inches at a time is OK until within 100 kHz of the desired frequency) from each leg and recheck for the frequency of lowest SWR. Repeat this process until the frequency of lowest SWR is within 25 kHz of the desired point. This completes the adjustments. Remove the analyzer and run the feedline to the

shack for use. By the way, it is not uncommon to be unable to reach an SWR of 1:1. However, 2:1 and below is quite acceptable for most purposes.

Note that the amount pruned from the legs must be equal on both sides. Additionally, when working on higher frequency antennas, you must prune less at a time. For example, on 17 meters a couple of inches at a time is appropriate.

In general, when the lowest SWR frequency is higher than desired, the elements (dipole legs in this case) are too short. If the frequency is below that desired, the elements are too long.

The advantages of antenna adjustments made in this manner are reduced QRM and the convenient lack of running back and forth between the shack and the antenna.

Antenna Tuner Adjustment

Want to eliminate another tuner-upper from the band? I sure wish everyone would! It's simple—just connect the analyzer to output #2 of a two-position self-grounding coax switch and your transceiver to output #1. The common output is connected to the input of your tuner.

To adjust the antenna tuner, select position 2 on the coax switch, set the analyzer to the desired frequency, and adjust the tuner until the SWR meter reading is at its lowest point. All this is done with no transmitted signal. Lastly, select position 1 on the coax switch and you are ready to transmit.

Frequency Counter

The MFJ-249 can be used as a frequency counter over its entire operational range. As with its predecessor, the 247 is not very sensitive and requires the use of a "times 1" probe for all but the most basic of frequency checks. However, all you have to do is put a rubber duck on the BNC connector and it's great for checking 2 meter mobile rigs and HTs. The readout is selectable from four to six decimal places.

Recommendation

Following the evolution of the MFJ SWR analyzers has been very interesting. They have all proved to be very useful and the MFJ-249 is the best yet. Having coverage from 160 through 2 meters is a definite advantage over the older models. For operational convenience, the SWR meter has been moved to just below the digital display and the non-sensitive controls moved to the top of the unit.

The MFJ-249 makes antenna work of all kinds easier, from tuning simple dipoles to adjusting traps on a triband beam to fine tuning HF mobile antennas. The analyzer is certainly a must-have device for Field Day, and with 2 meter capabilities it makes VHF mobile antenna adjustments a snap.

Since their inception, I have used MFJ SWR analyzers and would never go back to the old-fashioned method of transmitting a signal, taking a reading, going out to the

antenna and making an adjustment, returning to the shack, transmitting a signal, taking a reading, repeating, repeating, repeating! Being able to make all the necessary adjustments without returning to the shack is wonderful. As an extra carrot, I make no QRM while tuning my antennas. **73**

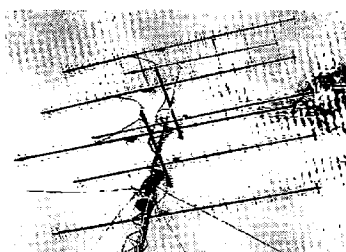
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CIRCLE 71 ON READER SERVICE CARD

by David Cassidy N1GPH

US Digital Company's DVR 501A Simplex Repeater System

US Digital Co.
380 Rougeau Ave.
Winnipeg, MB
Canada R2C 4A2
Telephone: (204) 661-6859
Price Class: \$166

In the last few years, low-cost microchips that are capable of recording digitally have become available. Several companies have come out with products utilizing these chips in such things as contest voice recorders, repeater IDers, repeater voice mailbox systems, and what is called a "simplex repeater." Until recently, simplex repeaters have been mostly large and costly boxes, but US Digital Co. (strangely, a Canadian company) has released a palm-sized simplex repeater that works amazingly well for the price.

What's a Simplex Repeater?

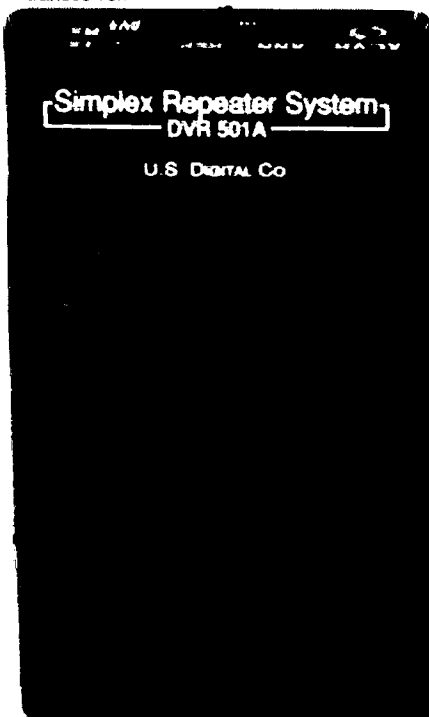
A simplex repeater records a transmission, then rebroadcasts the recorded transmission on *the same* frequency. If you place the simplex repeater in a good location, low-powered stations are able to communicate over much greater distances, as long as you wait for the repeating of your transmission. One situation that springs to mind where a simplex repeater would be useful is in emergency rescue work, especially in remote and mountainous areas. Drive your simplex-repeater-equipped car to a high spot (or, in very remote areas, air-drop a simplex-repeater-equipped package), and everyone involved in the search will be able to communicate without the need for a manned relay station. Those involved with this type of communications might want to leave a simplex repeater permanently wired into their mobile rig.

There are other uses for a simplex repeater. You can set it up in announce mode so that instead of repeating whatever is heard, a pre-recorded message is broadcast at a pre-determined time interval. This would be useful as an automatic IDer, a low-cost way of adding voice announcements to your club's repeater, a way to test your own station's quality, a propagation beacon, or in dozens of other situations.

US Digital's DVR 501A

US Digital has come out with the smallest simplex repeater available. The entire unit fits into a case that easily disappears in a shirt pocket. The unit is powered by a standard 9

volt battery, and comes complete with a pre-wired cable that is suitable for use with ICOM or Yaesu HTs (if you've got an Alinco, Azden, Kenwood or other HT, a little rewiring of the plugs is all it takes). The repeater simply plugs into the microphone and speaker jacks. It's a simple matter to wire up additional plugs to make the unit function with any other transceiver.



US Digital Company's Simplex Repeater System, shown at actual size.

All connections and the single mini-switch are on the top of the well-made black plastic case. The case is so tight that I had a little trouble sliding the battery compartment cover back on after installing the battery. Once I was successful, no amount of squeezing or shaking produced the slightest sound or movement. This case is solid! The mini toggle switch is used to choose between repeat and

announce modes. There are also two LEDs to indicate when a signal is being received or transmitted.

Once you have the Simplex Repeater System connected to your transceiver and switched to repeat mode, anything that is received will be recorded and immediately rebroadcast. The digital recording chip that is the heart of the simplex repeater provides exceptional audio quality with a 3.2 kHz pass-band.

To set up the announce mode, you start in repeat mode. The announce mode takes the last message recorded in repeat mode and continues to broadcast it approximately every seven minutes. This means that you need two radios, one with the DVR 501A wired in, and another to send the announce message. After the message is recorded in repeat mode, you move the toggle switch over to "announce." The DVR 501A will now rebroadcast the message until you switch it off or back to repeat mode (or until the battery gives out).

In Use

The small size and battery power of the US Digital Simplex Repeater System brings one particular use immediately to mind: With this unit and an HT, you've got an instant, easily-hidden transmitter for your next foxhunt.

While I wasn't able to use the US Digital unit in an actual foxhunt, I found many other uses for this little box. Instead of keying up your local repeater over and over again to test that new VHF or UHF beam, a simplex repeater wired into your home station allows you to get a signal on demand from any line-of-sight location. I recently attended a hamfest where the sponsoring club used a simplex repeater to broadcast directions from all the major local highways. They set it up on a 2 meter simplex frequency, and it ran all weekend without a flaw.

US Digital's little simplex repeater is one of those gadgets that you never thought you needed, but after you get one, you wonder what you did without it. Its low cost and small size make it even more versatile.

PACKET & COMPUTERS

Number 12 on your Feedback card

Jeffrey Sloman N1EWO
75 Herriott Street
Franklin IN 46131

This column will be a break from the continuing series on asynchronous communications. I don't do this lightly, since I have gotten a lot of positive feedback on the series. I chose to take a break because it has become clear that I need to write something else first.

Those of you who receive *Radio Fun* have seen my column in that publication. Since *RF* is targeted to a beginning audience I have written about the operations aspects of packet, and packet etiquette in particular. After discussions with sysops and users, I have decided that the readers of this column also need some information on this very important subject.

The Problem

There are many packet operators who are technically savvy.

They have no problem whatsoever in setting up their stations, and are often heard on the local repeater offering useful advice to those trying to get started in packet. These operators are a valuable resource to packet—no question about it. Unfortunately, you will rarely hear these same hams helping others with their operating practices, and the abuse of the (inter)national packet network has become a critical issue.

The loosely composed network of stations that comprise the system we depend upon to forward packet messages throughout the US is being swamped by frivolous, redundant, and sometimes even illegal traffic. Personally, I don't believe that the hams who are causing the problem are doing so intentionally—I think it is ignorance at work. This, coupled with a lack of local instruction for beginners at packet, is what has lead me to write this column.

Illegal Messages

I'll start with the most problematic class of mistakes—messages that cross the line of legality. These messages threaten the existence of automatic forwarding as sysops (SYStem OPERators) decide that it is not worth the risk to their license to forward messages that contain traffic contrary to FCC regulations, and that it takes too much time to manually check the content of each message that passes through their systems. (Note: The ARRL is currently trying to solve this problem by changing the regulation to make it clear that the sysop is not responsible for the content of forwarded messages—a reasonable interpretation of the current regulations. This is a good idea, but the problem should be eliminated at the cause: the sender.)

These questionable or outright illegal messages are almost always "for sale" messages. In fact, "for sale" messages are responsible for many of the problems faced by the packet networks. The most troublesome of these messages are those that seek to sell non-ham-radio items. This is not allowed by FCC regulations. Anything offered for sale on ham radio, be it by voice,

packet, or any other mode, must be directly related to ham radio. Here is the problem: A recent informal survey of a week's traffic on a local PBBS (Packet Bulletin Board System) showed that about 75% of the messages were of the "for sale" variety. Of these, more than 50% were about computer equipment—including parts, components, and complete systems.

Now, I know that a computer can be used as part of a packet station, and parts like floppy drives and SIMMs (Single In-line Memory Modules) can be used in computers, but these are not ham radio gear. They have many other possible uses. A Kenwood 450-S, as a contrast, is obviously a piece of ham gear. The use of the packet network as an over-the-air computer swap meet has two obvious negative consequences. First, it creates a potentially hazardous situation for sysops, should the Commission decide to interpret the rules in an unfavorable way. Second, it clogs the network with traffic better left to landline BBSs, which are prevalent and readily available throughout the country. The bottom line on this type of traffic is that unless you are selling

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Where's the Fun?

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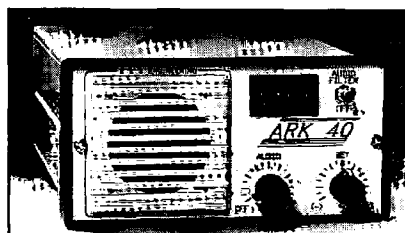
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CIRCLE 294 ON READER SERVICE CARD

a complete station—TNC, computer, and radio—it would probably be better to pass on packet as a method of advertising it.

Just Plain Silly

It is my own opinion that "for sale" traffic does *not* enhance the value of the packet network. However, I have talked with many hams who enjoy reading and responding to such messages. I am not here to tell you to stop trying to sell your ham radio gear via packet. On the other hand, if you are going to use packet to sell gear, please *think* before you do. When you see a message addressed to ALL@ALLUSA advertising a 70-foot crank-up tower—you *take it down*—you know that the sender:

A. Doesn't care about wasting bandwidth by sending his message to every BBS in the country when his tower could not be of interest to anyone outside of driving range of his QTH; or

B. Doesn't care enough to learn to address his message to just that area.

Reason A is just plain rude and reason B is not an excuse. If you are going to send a "for sale" message, start local, give it a chance,

then make a wider distribution. Yes, this is harder on you than sending an ALL@ALLUS message, but it is also courteous operation. Very frequently the item is sold to a local ham before the message even gets a chance to be forwarded outside your local area, anyway. If you are selling something that cannot be shipped, keep your traffic local. If you are selling something that is in demand, likely to sell quickly, keep your traffic local.

How do you address traffic to your local area? Each area has its own addresses that divide it up. The sysops in your area have these designations in their forwarding files so that traffic is distributed appropriately. If you don't know the address(es) for your area, leave a message for the sysop on your local PBBS asking. I am sure that he or she will be happy to provide the information. You may even be able to tell by looking at the traffic on the PBBS, since some of it is bound to be addressed to the local area.

More on Addressing

The idea that traffic should be addressed more selectively is not unique to "for sale" messages. Be-

fore you send ANY message, think about how it should be addressed. If you have a technical question about an AEA PK-232 MultiMode Controller—a very common unit—don't send your message to ALLUS! It isn't necessary. You are guaranteed to find the answer in your own state, probably your own town. By sending it to ALLUS, you just add to the burden of the already overburdened packet network.

On the other hand, if you have discovered a modification to the PK-232 that improves its AMTOR performance, and you want to share it, send it to something like PK-232@ALLUS. This is a perfect way to use ALLUS forwarding since it is a piece of technical information of use to all PK-232 enthusiasts. Notice, too, that I did not suggest addressing it to ALL, but to PK-232. This way, potentially interested hams will spot the message and will be able to use your wonderful new mod.

What's in a Name?

This brings us to message titles. If you have a good address—like in the example above, PK-232@ALLUS—then you just need to top it

off with a good message title. The point of the address and title of the message is to make sure that it gets to the right person. To accomplish this, the three parts must work together to get the traffic to its destination and then to engage the interest of the person you want to reach. Messages addressed to ALL@ALLUS, with titles like "hand-holds" just don't cut it. To complete the example from above, we might try something like:

PK-232@ALLUS Great AMTOR mod, just 3 caps

You can see where this kind of information will get it to your potential reader, and then entice them to read the message. Remember: You have 30 characters to work with in the subject line—use them well.

So, with a little thought and some desire to do the right thing, you can help make our packet networks a better place to operate. Cleaning up your packet act *will* help make a difference to everyone with whom you share the bandwidth of the packet network. Please, try to make a difference.

Next time we'll get back on track with our multipart series and I'll have some preliminary survey results. Till then, 73 de N1EWO. ✱3

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Using Operational Amplifiers

Operational amplifiers (op amps) were invented prior to the Korean War for use in analog computers; it's the math operations from analog computers that is meant by the term "operational." Interestingly enough, if you were to see the original Philbrick book on designing with op amps (copies are still in dusty book racks in college science departments, I am told), the circuits would look very much like those in modern op amp books. In this month's column we are going to look at the basic op amp circuits that are used in ham radio applications.

What are those applications? Well, the first that springs to mind is microphone preamplifiers. Also, you find these neat circuits in active analog filters, and in instrumentation circuits. Examples of the latter are Wheatstone bridges and antenna bridges where the minute DC signal produced across the detector can be amplified for display on an analog meter.

Figure 1 shows the basic circuit symbol for an op amp. The pin numbers given are for the popular 741 device, and this is considered the industry standard for a large number of products. Before hooking up some unfamiliar op amp, however, check the data sheet to see if it uses the "standard" pinouts.

There are two inputs on this device: -IN is the inverting input and produces an output that is 180 degrees out of phase with the input signal; +IN is the noninverting input and produces an output signal that is in phase with the input signal. Taken together, the -IN and +IN form a differential pair, i.e. allows us to build a differential amplifier. The output is single-ended with respect to ground.

Note that there are two DC power supply connections, and that neither of them is ground (see the inset for the typical op-amp power supply configuration). The V+ power supply is positive with respect to ground, while the V- power supply is negative with respect to ground. Some op amps also use either pins 1 and 5 or 1 and 8 for offset nulling or frequency compensation.

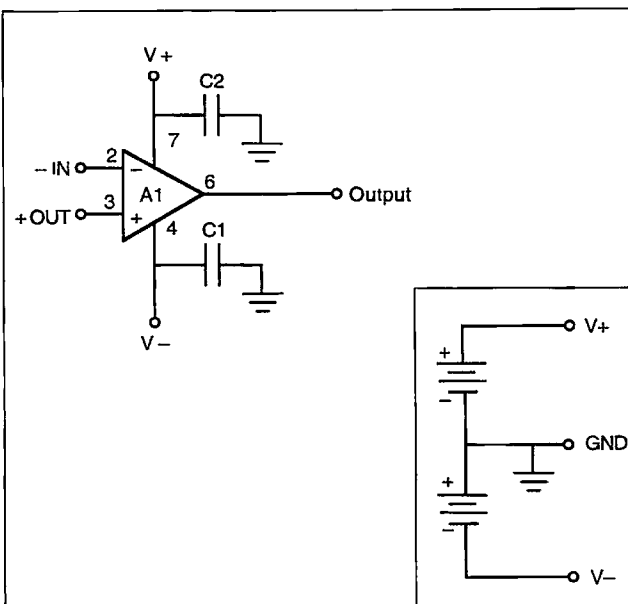


Figure 1. Typical op amp terminals, pinouts and power supply configuration. Pin numbers shown are the "industry standard" pinouts, and are from the 741 device. Check data sheet for any op amp other than 741, however, before connecting.

Op amps have very high open-loop (without feedback) gain (greater than 250,000 is typical). They therefore can be expected to oscillate all too easily. Even so-called "frequency compensat-

ed" or "unconditionally stable" op amps have been known to be rude enough to spuriously oscillate under the correct circumstances. Not good. As a result, most authorities recom-



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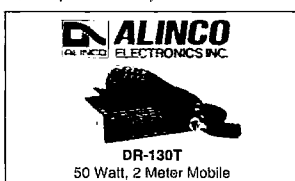
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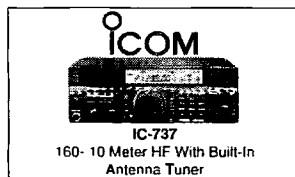
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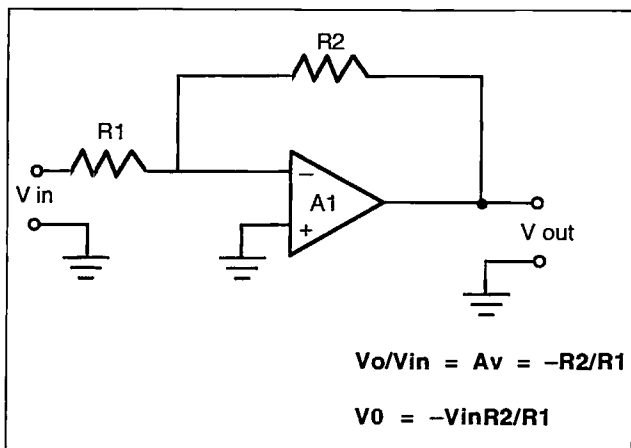


Figure 2. Inverting follower circuit.

ment that the power supply pins be decoupled with capacitors that have a value that will produce a very low reactance path to ground. In most cases, a value from 0.1 μ F to 4.7 μ F is used for C1 and C2.

Note that in Figure 1 there is no ground connection on the body of the op amp itself. Input and output signals are ground referenced, but the only ground *per se* is in the DC power supply circuit (see the inset to Figure 1).

In most of the circuits in this article you will find the DC power supply ter-

minals deleted. That is done for graphic simplicity, but in really-working circuits you would connect V- and V+ as per Figure 1.

Inverting Followers

Figure 2 shows the *inverting follower* amplifier circuit. This circuit produces an output that is 180 degrees out of phase (i.e., "inverted") with the input signal. Thus, $V_o = -A_v V_{in}$, the standard notation (A_v denotes "closed loop voltage gain"). The value of the voltage gain is set by the ratio

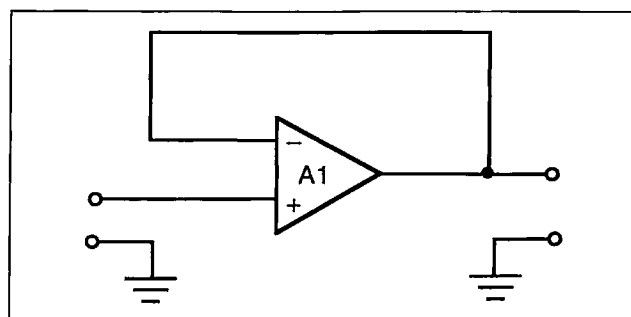


Figure 3. Unity gain noninverting follower.

of the resistors in the feedback loop:

$$A_v = -\frac{R_2}{R_1}$$

The "-" sign in the equation denotes phase inversion taking place. The output voltage, as a function of the input voltage and gain, is therefore:

$$V_o = -V_{in} \left(\frac{R_2}{R_1} \right)$$

For example, let's assume that we want a gain-of-100 amplifier with an input impedance of at least 10k ohms. We therefore set input resistor R1 to 10k ohms (or higher), and then calculate the value of R2 that produces an A_v of 100:

$$R_2 = R_1 A_v = (10k \text{ ohms}) (100) = 1,000,000 \text{ ohms}$$

For situations where gain is de-

sired, make R2 greater than R1, but if you want to attenuate a signal make R2 less than R1. When R1 = R2 the gain is unity (1), and when R2 is a potentiometer the gain is 0 to 1.

Noninverting Followers

The noninverting follower produces an output signal that is in phase with the input signal, and comes in two varieties: unity gain (Figure 3) and greater-than-unity gain (Figure 4). The unity gain follower is used for buffering, isolating and impedance transformation. It gets the latter job from the fact that it has a very high input impedance and a very low (less than 100 ohms) output impedance.

The greater-than-unity configuration of Figure 4, like the inverting fol-

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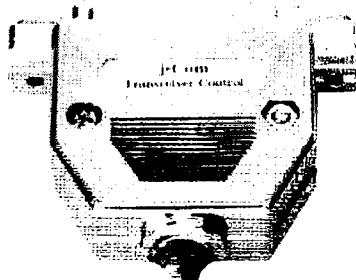
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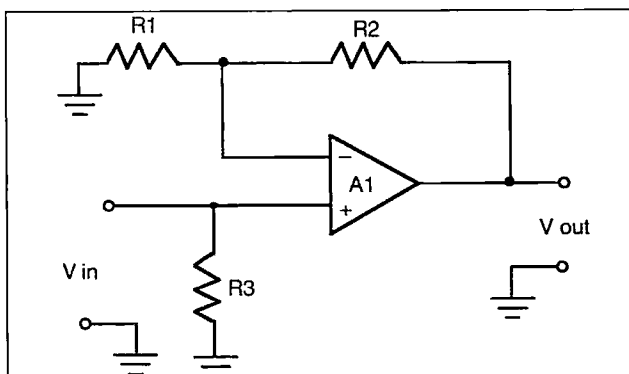


Figure 4. Greater-than-unity gain noninverting follower.

lower case, is a feedback network consisting of R1 and R2, but in this case the input resistor R1 has the "input" end grounded. The input signal is applied between the +IN terminal of the op amp and ground. In some cases, an extra resistor (R3) is used between +IN and ground in order to keep the output from saturating when the input line is opened. This situation occurs, for example, when the signal source is disconnected . . . as in when the microphone is removed from its jack.

The gain equation for the noninverting follower is a bit different from the inverting version, but is similar:

$$A_v = \left(\frac{R_2}{R_1} + 1 \right)$$

Note the absence of the "-" sign. It's not needed because the gain here is noninverting. The gain is one more than the resistor ratio. For low gains the extra "1" makes a large difference, but at high gains it is only a small error. For example, at a resistor ratio of 10:1 the gain is 11, and the difference between 10 and 11 amounts to 10 percent. But at a resistor ratio of 100:1 (as in the above example worked out) the gain is 101, so the error is only 1/100 or 0.01 (i.e. 1 percent). This little tidbit is not terribly useful unless you are stuck with standard value resistors. For making a gain-of-100 amplifier we can either find a 990k ohm resistor, or use the 1 megohm resistor and accept a 1 percent gain error.

Frequency Tailoring

Frequency tailoring is used in practical circuits to limit the signal spectrum, to limit noise, and to prevent the amplifier from oscillating. Capacitors can be used in simple op amp circuits to limit the frequency response. Consider Figure 5, a noninverting gain follower. The low end frequency response is limited by the combination of the input resistor R3 and capacitor C1. The -3 dB point is set by:

$$F_{-3dB} = \frac{1}{2\pi R_3 C_1}$$

For a microphone preamplifier, where the frequency response is typically set to 300-3,000 Hz, the combination of C1 and R3 would be set to 300 Hz or thereabouts. A combination of 100k ohms and 0.005 uF would do the trick. The upper end frequency response -3 dB point is set by the same equation, but with R2 and C2 substituted.

Single DC Supply Operation

A lot of ham applications of op amps do not like the dual DC power supply requirement of these little ICs. There is a way to operate them from a single DC supply, even though it is suboptimum from several points of view (e.g. output voltage swing, DC component on the output signal, etc.). Figure 6 shows how single supply operation can be obtained in either form of op amp circuit. The VDC power supply terminal on the op amp is

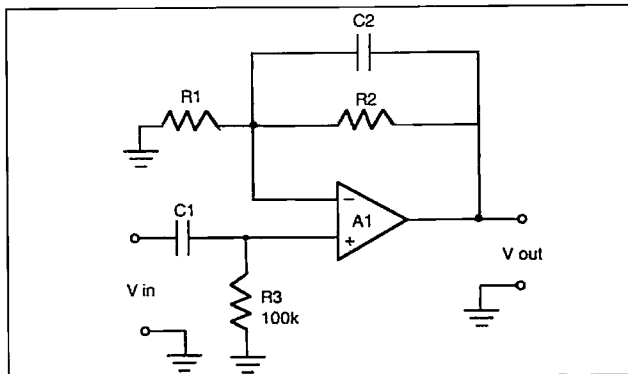


Figure 5. Frequency response tailoring with input and feedback capacitors.

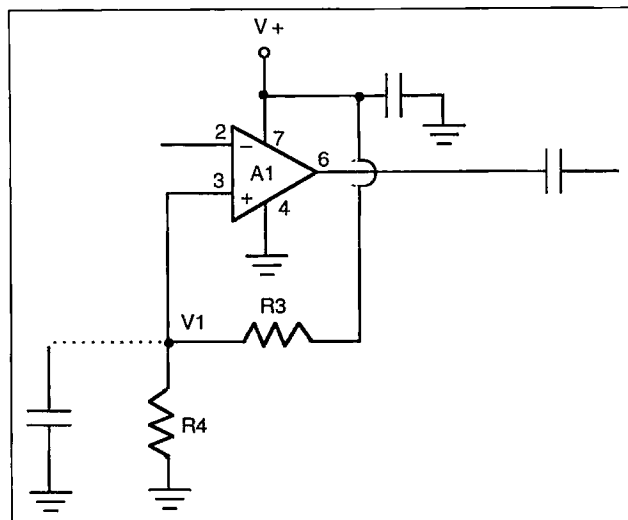


Figure 6. Operation from a single DC power supply.

grounded, and the V+ terminal is connected to the positive DC power supply. A resistor voltage divider (R3 and R4) is used to bias the +IN input to some voltage V1. If R3 = R4, then V1 is one-half the DC supply voltage. This same voltage appears at the output of the op amp, so it's common to use a capacitor coupling to the "outside world." In some cases, where it is desired to keep the +IN input grounded for AC signals, a bypass capacitor is shunted across R4. This capacitor should have

a reactance that is less than R4/10 at the lowest frequency of operation . . . and the lower the better (I like R4/100 or less in my circuits).

Additional op amp circuits can be found in any of the many good books on the subject. Check either of my titles in the TAB/McGraw-Hill *Mastering* . . . series (one on amplifiers, the other on IC electronics). TAB can be reached toll-free at 1-800-233-1128 (in PA use 717-794-2191), or by mail at Blue Ridge Summit PA 17294.

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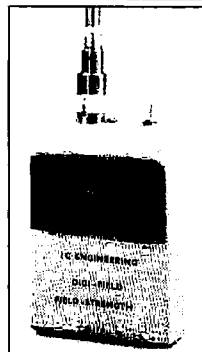
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Since the April 1993 "Hamsats" column and its focus on KITSAT-OSCAR-23, activity via this satellite has increased dramatically. During many passes over North America, the download request queue has been full, while many other stations stand by waiting to get in line to fill holes in incomplete files or to initiate new files. Pictures, voice mail, software, bulletins and messages from hams all over dominate the directory listings. With its higher-than-average low earth orbit of 1,300 km and high-speed 9600 bits-per-second (bps) frequency-shift keying (FSK) signaling rate, K-O-23 has become the most popular digital amateur satellite.

History

In 1989, the Satellite Technology Research Center (SaTReC) at the Korean Advanced Institute of Science and Technology (KAIST) began a joint effort with the UoSAT group at the University of Surrey in England to design and build a satellite for amateur radio communications and educational experiments. Sponsors in South Korea include the Ministry of Communications (MOC), the Ministry of Science and Technology (MOST), the Korean Science and Engineering Foundation (KOSEF) and Korea Telecom.

KITSAT-1, or KITSAT-OSCAR-23, was launched on August 10, 1992, from Kourou, French Guiana, as a secondary payload on the Ariane Structure for Auxiliary Payloads (AS-AP). This was the first Korean satellite of any kind and provided an opportunity for graduate students at KAIST to learn firsthand about satellite design and construction.

The primary objectives of the program were to acquire satellite development technology, enlarge the number of engineers experienced with spacecraft engineering, motivate

youth through space education, and widen the South Korean national interest on space science and satellites.

The experiments on board K-O-23 include the 9600 bps packet bulletin board system (BBS), the earth imaging experiment, a digital signal processing (DSP) experiment, and a cosmic ray experiment. All these systems have performed well.

The packet system has excellent transmit and receive characteristics. The power output is strong and correctly modulated and there have been few software crashes. The CCD (charge-coupled device) cameras have provided excellent black-and-white earth views. The DSP experiment has been heard "speaking" and the cosmic ray detector system has been providing data for study by those monitoring the telemetry. It is hoped that K-O-23 will continue to perform its radio and experiment functions for several years.

KITSAT-B

The SaTReC group is working on a new satellite scheduled for launch on August 31, 1993, once again from Kourou, French Guiana. Many of the experiments and activities planned for this hamsat are similar to K-O-23, but with improvements.

The transmitter and receivers will be similar to K-O-23 and will use the highly successful 9600 bps data transfer system with BBS operation. The main experiments will include a new camera system, an enhanced DSP experiment, an electron detector and an infra-red sensor device.

CEIS, or CCD Earth Imaging System, is designed to capture high and low resolution images of the earth using two separate cameras. The wide-angle system has a viewing angle of 76 degrees and a coverage of 1,022 by 990 km. The mean resolution is 2 km square and will provide black and white or color. A typical image file will require 250 Kb. The narrow-angle

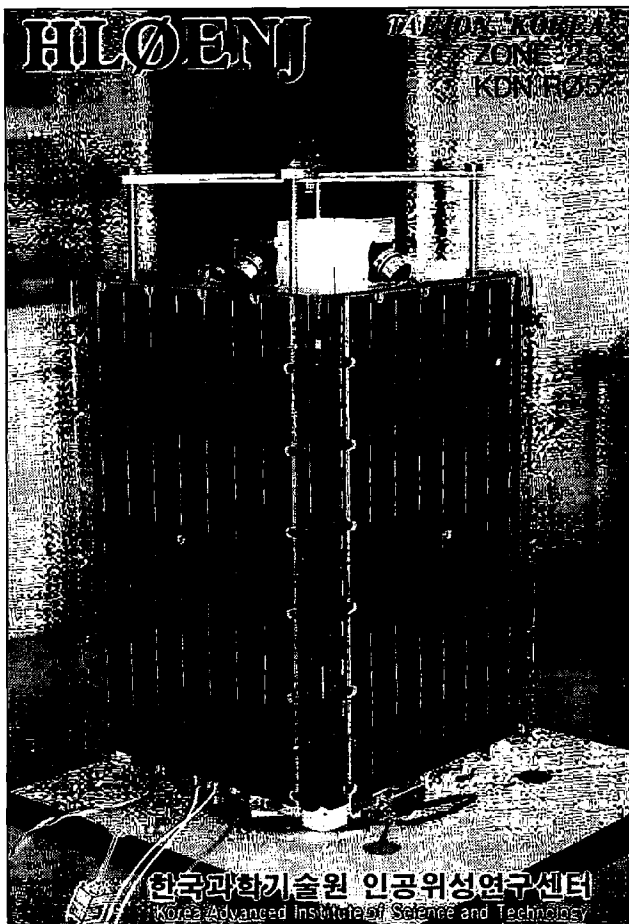


Photo A. KITSAT-OSCAR-23 prior to launch.

camera has a viewing angle of 12 degrees and sees an area 116 by 115 km. Resolution is 200-m square with black-and-white pictures of 350 Kb each. Both cameras can be commanded to take a picture at the same time. This results in the narrow-angle camera effectively zooming in on the center of the image captured by the wide-angle unit. Image processing and compression will be performed on the satellite to provide fast downloading of pictures.

The DSPE, or Digital Signal Processing Experiment, will carry two units. The DSPE 30 is the primary system, with a TMS320C30 processor. The back-up unit employs a TMS320C25 chip and can be used in conjunction with the primary unit through a dedicated high-speed link when extra computational power is required. The system is similar to that on K-O-23. An enhancement over the previous system is the possibility of data transfer experiments at speeds greater than the 9600 bps hardware modem.

The LEED, or Low Energy Electron Detector, is designed to measure the electron flux in space and analyze the energy spectrum of the electrons in the auroral region. The system consists of four main components, including an electrostatic analyzer, spiraltron

electron multiplier, high-voltage supply, and control unit. LEED can detect electrons with up to 6670 electron volts (eV) in 16 steps, with a resolution of 20 percent. The signals from the detector are fed to an analog-to-digital converter and then through control logic to the satellite's data handling system.

IRES, or Infra-Red Sensor Test Experiment, incorporates special sensors manufactured and calibrated at KAIST. IRES is an instrument to monitor the changes in the current and voltage characteristics of an infra-red sensor in a space environment. The sensor will be placed in a thermally-insulated housing with a window that looks out the top of the spacecraft. The experiment's electronics will monitor both the temperature change of the housing (since the detectors must operate at very low temperatures) and the degradation of the sensor over time.

KITSAT-B will become KITSAT-2 after launch. At that time it will also receive an OSCAR number. Although August is only a few months away, there are other satellites that may be in orbit first, including ARSENE from France, RS-15 from Russia, and UN-AMSAT from Mexico. It's getting crowded up there. Amateur satellite activity has never been better.

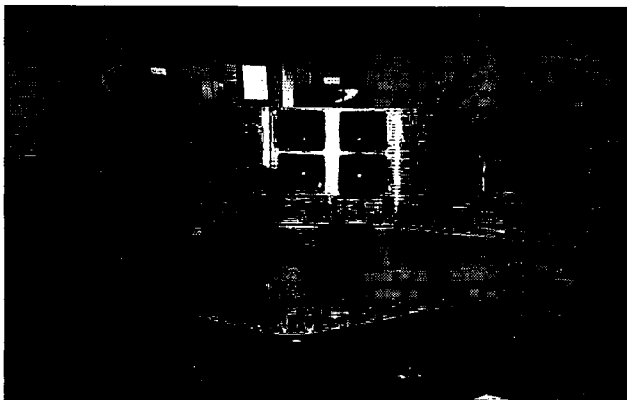


Photo B. Kyeongil Choi at the KAIST control center in Korea.

RTTY LOOP

Number 15 on your Feedback card

Amateur Radio Teletype

Marc I. Leavay, M.D., WA3AJR
6 Jenny Lane
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It's an interesting time warp we write columns in. As I write these words, the Blizzard of '93 has just finished ravaging the East Coast. This "storm of the century" disrupted many plans, including a family affair we had been planning for several years. Our event has been rescheduled for June, just as this column will be published. Strange but true? You be the judge!

Anyway, that aside, here is a little note from Tom Vicinanza WA2UCH of Orlando, Florida, sent over the CompuServe network. Tom states that he read, with interest, my February 1993 column on getting an old Model 28 Teletype machine back on line. He has a Model 28-KSR about which he has some questions. Tom has a loop supply, made for the US Navy, which delivers 20 mA at 130 VDC. This loop supply appears to be an interface, and is labeled a "TeleTerminal." At any rate, his problems are where to put the current and where to connect the signal line. The machine has a polar relay, so the wiring will be different from that published in the February column. He believes that if the current is applied to terminal C5 (Black +) and C15 (Red -) that should be correct, but he doesn't see where to put the incoming signal from a decoder. Still C1 and C2? He asks how he can get his machine to run local, postulating that he could provide a closed loop to create the "sitting idle" effect, then connect the loop to the outputs of the TeleTerminal (or similar device) to print data.

Well, Tom, without knowing the circuit diagram of that "TeleTerminal," it is hard to say. Further, the circuit published in the February "RTTY Loop" was for a Model 28-RO, that is, Receive Only, as opposed to your Model 28-KSR, a Keyboard Send/Receive machine. Nonetheless, we can draw some conclusions. First of all, your polar relay needs a bias supply to keep the relay closed. This may well be provided by the TeleTerminal. The loop is interrupted by the signal, switching it on and off in step with the RTTY pulses. The interface, commonly called a "demodulator" or "terminal unit," normally takes care of this. Some terminal units provide an integral loop supply, which supplies the necessary loop current. Others terminate with an electronic switch, which serves to impress the RTTY signal onto an external loop. Whatever, you must determine the proper terminals to make the machine idle, then feed the loop signal into those terminals. Good luck, and I look forward to hearing from you with your results.

TUWIN Program

Another CompuServer is David Ventura KE0NA of Burnsville, Minnesota. He details purchasing an AEA CP-1 awhile ago, and building an RS232 interface for it using Radio Shack 1488 and 1489 chips. Built on a small board with jumpers to two wire-wrap sockets, the board plugs into the two sockets on the CP-1 board that use the old-style RS232 chips. He has been on RTTY for a few weeks and enjoys it very much.

Dave tells us about a program

called TUWIN. It works quite well and he is able to fill the buffer as the other station sends, which keeps the QSO going quite nicely. He notes that the mode is just what he expected it to be: good old-fashioned rag-chews, no talking to BBS computers, and real people. Well, Dave, I hope you will send along a schematic of the interface you put together, and I will pass it along to the multitudes. But for the time being, I took a look at that TUWIN program you mentioned, and it is an interesting little program.

Written by Wayne E. Wright W5XD, it is designed as an accessory to the WriteLog Windows logging program to allow Windows-based logging and RTTY for contesting, as well as general operations. TUWIN works with old-

want a copy of TUWIN, as mentioned in the June 1993 column.

The parent program, WriteLog, is available from Austin Code Works, 11100 Leafwood Lane, Austin, Texas 78750. Just be sure to tell them you read about it in 73 Magazine's "RTTY Loop," ya' hear?

Besides TUWIN, I continue to have several disks of RTTY and PC type programs available for a song. Collections #1 and #2 are RTTY and amateur radio programs; collection #3 is a bunch of archiving and utility programs for both DOS and Windows. Each collection will fit on a 1.44 Mb, 3.5" disk. One or two programs may be lost trying to cram them onto a 1.2 Mb 5" disk, and you will need to send a whole bunch of low density disks if

"Overall, this is a neat, if bare-bones, approach to using an older terminal unit on RTTY..."

style RTTY terminal units, like the HD-3030, MFJ-1229, or HAL ST-6, that do not do internal Baudot to ASCII conversion. It thus should not be used with multimode controllers like the PK-232 or KAM. With a split screen display, text to be transmitted is entered into the lower window, received text is displayed in the upper window.

The program uses the DTR and RTS lines on the serial port to indicate "transmit," with the lines being keyed about 500 mSec before the first character is sent, and continuing until about 500 mSec after the last.

Overall, this is a neat, if bare-bones, approach to using an older terminal unit on RTTY, with a spiffy Windows display. TUWIN is available on CompuServe, in the HamNet SIG, or can be obtained from me for the customary \$2 in US funds, 5" or 3.5" disk, and a STAMPED self-addressed disk mailer. Be sure to tell me that you

that is your requirement. Anyway, for any or all of the collection, send me sufficient media, a return mailer with sufficient postage affixed, and \$2 in US funds for each disk to be filled, to the above address. I am trying to turn these around within a few days so, if you have sent me a disk or disks and haven't heard in a reasonable period of time, drop me a note or E-mail message to make sure I received the original package.

See, the folks this month communicated with me via CompuServe, using my ppn, 75036.2501. Others have used America On-line, via MarcWA3AJR, and Delphi, also via MarcWA3AJR. You can do it too! I'll even register you for an America On-line sign-up kit, if you supply me with your name, address, phone number, and computer data. Sure, the U.S. Postal Service is fine, too, it's just so archaic!

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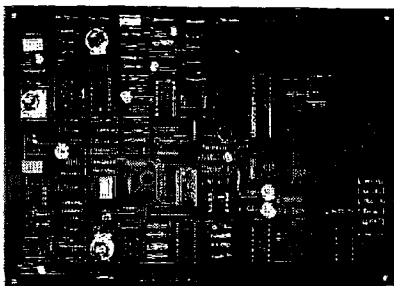
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Medal-Winning and Record-Breaking T-Hunts

Wichita, St. Louis, Toronto, Salem (Oregon and North Carolina), and Montreal have something in common. They are all cities with new and growing interest and enthusiasm for amateur radio direction finding (RDF) contests. In these hidden transmitter hunts (often called foxhunts or T-hunts), hams use special receiving equipment to find stations placed in unusual spots by other hams.

I learned about this new-found interest via letters and electronic mail from hams in each of these cities, plus others, in recent months. Many of them read about foxhunting for the first time in *73 Amateur Radio Today*.

Pack Your Toothbrush and HT

The 1993 Friendship Radiosport Games (FRG-93) are almost here. Here is your opportunity to take part in a world-class international on-foot foxhunt at a beautiful venue in Victoria, British Columbia. Kevin Kelly N6QAB/9K2FX, winner of the 1991 Friendship Games foxhunt, is expected to defend his medal, coming to the Games from his work assignment in Kuwait.

Foxhunters from Portland, Oregon (site of FRG-91), will be there, along with teams from California and Washington. Fifteen hams from Khabarovsk, Russia (site of FRG-89), will arrive in San Francisco on June 19 and proceed to Victoria for the contest and two weeks of international hospitality. Also expected are hams from Niigata and Morioka, Japan.

The FRG-93 foxhunt is expected to follow international standards, which

call for five "foxes," transmitting in sequence for one minute each on 2 meters. Total course length will be about two miles. RDF equipment is being provided by the sponsors for your use, so you can travel light.

In addition to the foxhunt, there will be optional CW sending/receiving contests, a special events station (callsign X07G), and a hamfest. At the hamfest you will find a swap meet, commercial displays, and a portable IPARN 2 meter satellite link across Canada.

Most events, including the foxhunt and CW contest, are scheduled for Saturday, June 26, at the spacious campus of Camosun College. An evening awards banquet will follow the competitions.

In recent conversations, I discovered that some hams think the Friendship Games are restricted to national champion foxhunters. Not so! Anyone who enjoys radiosporting is welcome. It's all for fun, in the spirit of international friendship and ham camaraderie.

For more information and to reserve your spot at FRG-93, write to FARS-Victoria, c/o Camosun College, Box 128, 3100 Foul Bay Road, Victoria, BC, Canada V8P 5J2. The information phone at the college is (604) 370-4420. Packet messages may be addressed to VE7KPV@VE7VBB.#ISLAND.BC.CAN.NA.

Be sure to indicate if you desire housing information. To find out more about what it's like to take part in international radiosporting, read "Homing In" for September 1991 and "Showdown in Portland" in the November 1991 issue of *73 Amateur Radio Today*.

A New Record for the Granddaddy Hunt

The Southern California All Day Mobile T-Hunt has taken place at least four times a year for as long as anyone can remember. There are only a few rules. The hider's 2 meter FM simplex signal must be copyable at the starting point. The T must be within the continental USA (no offshore islands, maritime mobiles, or trips across the Mexican border.) Lowest odometer mileage determines the winner; time doesn't matter in scoring. Nowadays, hiders and hunters are a bit disappointed if the hunt doesn't last at least 24 hours.

Just like other ham DXers, some hiders try to see how far away they can be. N6MI and WA6FAT set a record when they led the hunters to 8,351-foot Shuteye Peak near Yosemite National Park, 252 miles away from the starting point southwest of Los Angeles. For the February 27 All Day Hunt, Jim Forsyth AF6O and Eric Nansen N6YKE decided to immortalize themselves by increasing this record by 36 percent.

Jim told me that it was a lucky QSO that alerted him to the possibility of a record-breaking hunt. "The month before, a weekend hunt coincided with the January VHF contest. We ended up on Table Mountain looking for the hidden T, which wasn't there. While there, we decided to work a bit of the contest on 2 meters. We worked a guy who was putting in a strong signal from Utah. We got him to tell us where he was and how much power he was running."

"He told us that he regularly

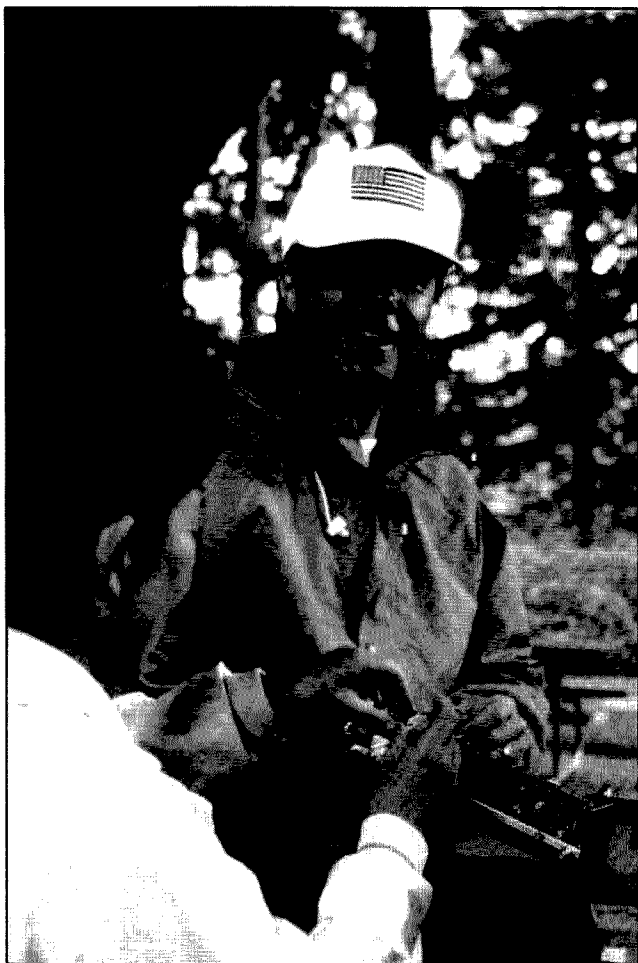


Photo A. Kevin Kelly N6QAB/9K2FX looks over a new Japanese RDF set brought by Yoshiko Yamagami JQ1LCW to the 1991 Friendship Radiosport Games.



Photo B. Eric Nansen N6YKE and Jim Forsyth AF6O set a record by hiding 344 miles away on the Southern California All Day T-hunt.

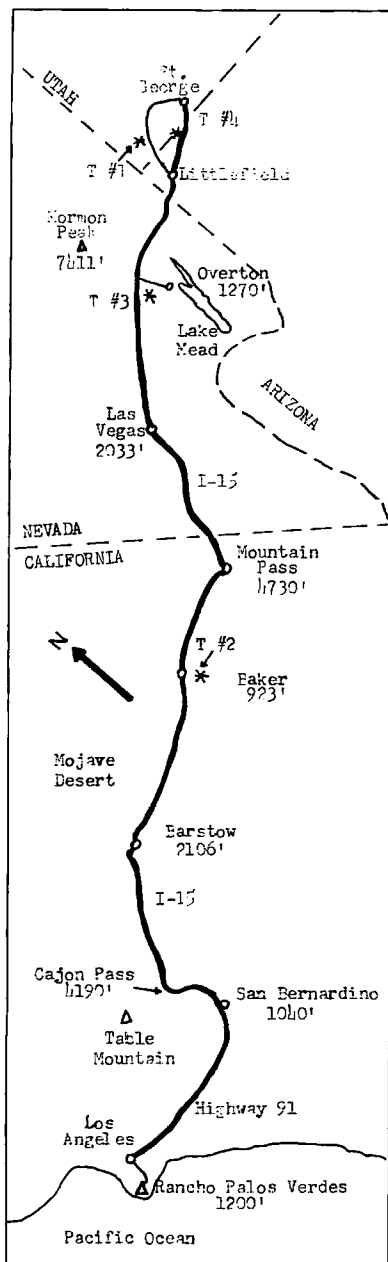


Figure 1. The shortest route to the four T's in the February 27 record-setting hunt lay mostly along Interstate 15, with lots of ups and downs. An accurate bearing at the starting point was crucial for success.

worked people in Los Angeles and Orange Counties from that spot," Eric added. "Jim told everybody that we had found our spot for the February 27 hunt on this outing, which led them to believe we would be near Table Mountain, only 59 miles from the starting point."

The record-setting spot is called Utah Hill. It's along a stretch of old US Highway 91 from Littlefield, Arizona, to St. George, Utah, passing by Jarvis Peak. "It looks right down on the Grand Basin," according to N6YKE. "Except for a little ridge in the valley, we had 2,500 feet of elevation over

everything between us and Las Vegas and beyond."

Would they be able to get a reliable signal across the 344 miles between this 4,724-foot mountain pass and the starting point? Jim obtained a 600 watt amplifier, a pair of car batteries to provide 28 volt power, float chargers and a generator.

On the day before the hunt, they went to the site to test with WB6ADC at the Rancho Palos Verdes starting point and N6XTJ on a hilltop in Orange County, keeping in touch on 40 meter mobile SSB. They transmitted 600 watts into a 15-element KLM Boomer yagi for an hour and a half with no success. Then they moved their set-up down the hill about 150 feet. Immediately, both WB6ADC and N6XTJ heard them clearly on 2 meters with their T-hunting quads.

A successful test doesn't necessarily mean a successful hunt, however. Over this distance, 2 meter propagation varies with time of day and weather, and the weather was changing. "On hunt day, we encountered snow at 3,500 feet on the way to the site," said Jim. "It turned out to be no problem driving there. There were three to four inches of snow, but it was melting fast. Propagation peaked before start time, but the hunters heard us OK."

Now the hunt was on. Transmissions continued at 600 watts for two hours. Then Jim and Eric shut off the generator and dropped power to 15 watts. Hunting teams that were taking the correct route would be crossing 4,250-foot Cajon Pass summit by that time, and could still hear the signal.

One Is Not Enough

At starting time, only the Utah Hill T was on the air. But participants in Southern California All Day Hunts are alert for the possibility of multiple foxes. Sure enough, T #2 appeared two hours later, long before any teams got close.

"We hid it Thursday morning on our way out and set the timer to come on at noon Saturday," said N6YKE. "It was on Kelbaker Road, 0.4 miles south of the freeway off-ramp at Baker, California."

The third T was on Highway 169, which goes south from I-15 to Lake Mead at Overton, Nevada. "It was hidden on the northeast side of a hill with

a beam pointing at Mormon Peak, a 7,411-foot mountain on the north side of I-15," said AF6O. "As you headed northeast on I-15, you couldn't copy the direct signal. All you heard was the reflection from Mormon Peak. Quite a few hunters got fooled by that."

The fourth T was near the I-15 Virgin River Gorge rest area in Arizona, nine miles beyond the Highway 91 exit to Utah Hill. "You had to get off at the rest stop and take a little dirt road on the opposite side of the interstate," said Eric. "People were 'sniffing' at the rest stop because it was pointing at a cliff there. One team took several hours before they found it."

Once they got T #4 in place, Eric and Jim drove down I-15 toward Las Vegas, listening to the chatter on the hunt frequency and on the 40 meter SSB coordination frequency. They met up with hunter J. Scott Bovitz N6MI around dark and all three decided to go to a casino for dinner.

"Sure," Scott confirmed. "As long as we were in Vegas, we might as well get three-dollar steaks."

"Then Scott decided to spend a few minutes on the roulette wheel," Jim said. "So he bought a few chips, won about five dollars, cashed in, and continued on the hunt."

"Scott said he thought T #1 was about 40 miles further up the road at one of the microwave sites," Eric continued. "So he wasn't in any big hurry. We also found out that he didn't have good maps of the area. We were following him from Vegas toward Utah and he stopped at a mini-mart. Jim realized why, so he jumped out, ran into the store and bought up all the Utah maps before Scott could get one."

As it turned out, N6MI found all T's in lowest mileage order (2-3-4-1), despite his lack of maps. He won the hunt with 460 odometer miles from starting point to T #1. Scott arrived at Utah Hill after midnight in a snowstorm. "It was just perseverance," he explained. "But it was a whiteout condition at the end. You could see better with headlights off than on."

Eventually, five of the six starting teams found the Utah Hill station. Four teams found all four T's, although some had poor mileage be-

cause they found them in the wrong order. "All T's were just off the pavement," said N6YKE. "We didn't make them too difficult, because we didn't want to be out forever."

Four transmitters in four states on one hunt! And you East Coast dwellers, who can drive through five of your tiny states between breakfast and lunch, remember we're talking big states here. Can other hiders top this? You can be sure some are studying topographical and relief maps trying to find a way.

Start Small, Have Fun

Don't get the idea that every hunt in Southern California is a marathon event. In Orange County, four clubs have begun monthly mobile outings just for beginning RDFers. They take place on various repeaters on week-day evenings, usually right after a club net, when listenership is high.

The hider makes short, frequent transmissions on the repeater input, urging every listener to get in the car and participate. Boundaries are small, usually just the county or part of it. After awhile, the fox station helps hunters by announcing smaller boundaries or giving other clues.

The idea is to insure that everyone finds the T in a reasonable period of time. To keep newcomers coming back, they need an evening of fun, not an ordeal. With a few short hunt successes, perhaps they will try longer-range hunts.

Pick Up Your Pen

I'm happy to get your letters telling about foxhunt activities in your area. I'm also pleased to see that new RDF equipment is becoming available in circuit board, kit, and assembled form, from a variety of individuals and companies. Beginning next month, "Homing In" will review some of these new offerings.

If you know of a new piece of fox-hunting equipment, want to tell about your experiences with home-brew or commercial gear, or want to pass along news of your local hunts, write to me at the address above. Send E-mail via CompuServe (75236.2165) or Internet (JoeMoell@cup.portal.com).

UPDATES

Number 17 on your Feedback card

Computer Control for the Ramsey FTR-146

Refer to the above article on page 60 of the March 1993 issue. Due to a typesetting error, five lines of the program shown on page 68 have a less than (<) symbol substituted for an asterisk. These lines should read:

```
450 IF A=0 THEN HLDFFREQ=VAL(FREQ$)*1000: MODE$="S": GOTO 480
460 HLDFFREQ=VAL(LEFT$(FREQ$,A-1))*1000
40380 FREQ=(FREQ*1000)/143000!: OFS=0
40400 FREQ=(FREQ/10)*128
40450 FREQ2=FREQ*(FREQ*1256)
```

The Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Scope It Out

Quite awhile back, I wrote about oscilloscopes and how great they are. If you're inclined to repair or build anything, you will find no tool more useful than a scope. You can find them at very reasonable prices, both new and at hamfests. Oddly, most hams I've talked to seem afraid of scopes, simply because they've never used them before and don't really know how to operate them. Besides, there are just so darned many knobs and buttons! This time, let's explore scopes in more depth and take a look at what the various features controlled by those knobs can actually do for you.

The Basic Beast

Essentially, a scope is a graphing machine. Specifically, it produces a fleeting graph of voltage over some specified period of time. The faster a signal it can graph, the "faster" the scope is said to be, and the more expensive it is. For HF circuits, a 50 MHz scope, which is pretty common these days, should be fast enough. For VHF and UHF, though, the cost of a capable scope will probably put it out of reach. Sometimes you can get lucky; I bought a 150 MHz scope at a hamfest for \$200. Sure, it was a risk, but the temptation was just too great to ignore. That scope lets me work on 2 meter rigs with great success because I can actually view the signals at 148 MHz! Some exotic lab scopes go to beyond 1 GHz, but you won't find one at a hamfest.

It's incredibly useful to be able to see how a signal changes over time, and it's not particularly hard to do, but that may seem hard to believe when you look at the front panel of your scope. It seems like there's enough there to pilot the space shuttle! So why are there so many confusing knobs and buttons on today's scopes?

One Size Doesn't Fit All

Scopes seem complicated because their screens are of finite size! And a pretty small size to boot. Let's face it, you really can't see that much at once. Most of the controls are there to let you scale the signal and scope parameters in such a manner that you can see what you want to see.

With the exception of a few new,

expensive LCD pocket models, oscilloscopes use cathode ray tubes (CRTs) similar to those in TV sets. So, naturally, there are some controls dedicated to adjusting the electron beam itself. You'll find brightness and focus, and those are self-explanatory. You might also find an astigmatism control. That one keeps the shape of the electron beam from getting stretched out as it sweeps up and down. Depending upon the signal you're looking at, you may have to adjust any or all three of these things to get the clearest view. On better scopes, though, the focus and astigmatism tend to stay put over wide signal variations, and some don't even need to have astigmatism controls.

There are many ways to use a scope, but by far the usual way is to graph voltage over time. (Other ways include frequency vs. time, two signals vs. each other, and more.) Because we're working with the good ol' Cartesian (X/Y) coordinate system here, our two basic parameters are horizontal and vertical. You move the CRT's electron beam up and down (X) in step with the incoming signal you want to view, and you sweep the beam from left to right (Y) at some predetermined rate. Let's look at the X (vertical) issues first.

Squeeze Me, Please

The object here is to squeeze the signal down so that all of it remains on the screen. Well, usually. Sometimes you want to see some small part of it which is near the middle or the top or bottom and you don't care if other parts are lost over the screen's edges. Either way, the VERTICAL AMPLITUDE control lets you make it as big or small as you want. Most scopes use a 1-2-5 arrangement for maximum convenience. What I mean by that is that the steps on the control are arranged like this: 100 mV, 200 mV, 500 mV, 1V, 2V, 5V, and so on. I can't explain why that arrangement is so nice to use, but if you try it, you'll see that it is; it just gives you steps that seem to fall where you want them. By the way, those numbers refer to the amount of voltage it will take to move the beam up or down one box on the graticule, which is the set of boxes drawn on the CRT's faceplate.

Concentric with the vertical amplitude control is a variable knob which lets you set values in between those you can select with the stepped knob. When turned all the

way up, the variable knob is said to be in the calibrated position, which means that the number you select on the stepped knob will be correct. So why would you possibly want to *uncalibrate* your oscilloscope? Usually, you only do that when you need to take a comparative measurement—say, for instance, that you want to see if one signal is just a little bigger or smaller than another. The reference signal is 3.47 volts peak-to-peak, so neither of its peaks hits any of the graticule markings. Now you look at the other signal and, gee, it kinda looks the same, but it could be a little different. If you go back to the reference signal and use the variable control to reduce it until its peaks line up with some of the graticule markings, it becomes much easier to tell how another signal, or the same signal at a later time, compares. Just be sure to reset the variable control to its calibrated position when you're through. I can't tell you how easy it is to forget to do that and spend the next two hours going around in circles because you're working with an incorrectly calibrated instrument!

Going Up?

Somewhere near the amplitude control (also sometimes called the "attenuator") you'll find a position control. All this does is let you move the entire waveform up or down in order to line it up with the graticule. It does not make the signal bigger or smaller; it just shifts its position. You may also find an "invert" button. That lets you flip the waveform upside down. It can be handy if it helps you to visualize what is going on in the signal, and it is especially useful with multiple-channel scopes (which we'll get to later) because it lets you subtract signals from each other in order to see tiny differences between them.

AC/DC

Not the rock band. This button lets you select the type of coupling between the probe and the scope. If you select DC, any voltage level, even a non-changing one, will move the trace on the CRT. That's handy for checking DC voltages and offsets. If you pick AC, though, a capacitor is placed in series with the probe, and the scope will only display *changes* in the signal. Ironically, that's most useful on DC signals! You use it when you want to see, for instance, how much ripple there is on a power supply's output. If you're testing a 12 volt supply, you can't see 100 mV of ripple because the trace would be way off the screen at that scale. But, with AC coupling, the 12 volts are blocked, and you can set the amplitude control as sensitive as you need it.

Then, 100 mV of ripple can fill the entire screen!

A Probing Topic

No discussion of an oscilloscope's vertical stages would be complete without talking about the probe you use to connect the scope to the circuit you're examining. It may seem obvious that the probe is nothing more than a piece of wire, but that often isn't the case. Most probes are either 10:1 or switchable 1:1/10:1 types. The ratio refers to the amount the probe will attenuate the signal before it enters the scope's input stages.

Why the heck would you want to do that? Two reasons: First, the signal may be so big that, even with the amplitude knob set to its highest range, the waveform won't fit on the screen. That happens, but not all that often with today's solid-state gear, which uses fairly small signals in most stages. Second, reducing the signal right at the probe raises the apparent input impedance of the scope by the same factor. So, if your scope has a 1 megohm input impedance and you use a 10:1 probe, your circuit sees a 10 megohm input impedance instead of the 1 meg it would see with a direct connection. That is very handy because it avoids loading down the circuit and the false readings that can result. In practice, it usually pays to use the 10:1 setting and make up for the gain loss by increasing the scope's sensitivity with the amplitude control. Of course, if the signal is extremely small, you may not be able to do that, and you'll have to switch to the 1:1 setting on the probe.

Passive Resistance

The probe's attenuation is provided by a simple two-resistor network. There's a resistor in series with the tip and another to ground at the first one's other end. The scope connects to where the two resistors meet.

If you look at a 10:1 probe, you'll notice a small screwdriver adjustment. This lets you set the probe's capacitance to match that of the scope's input stage. If it's set wrong, signal peaks will be either exaggerated or squashed down. To make sure it's set right, connect the probe to the scope's CALIBRATE pin. That pin provides a square wave, usually at about 1 or 2 kHz. All you do is set the probe to 10:1 (if it's switchable), set the scope's coupling switch to DC, and turn the probe's adjustment until the tops and bottoms of the square wave are as flat as you can make them. If your scope has no CALIBRATE pin or its oscillator is broken (as it is on one of mine), you can use any rea-

sonably clean 1 kHz square wave. If you change the probe to another channel or use another probe, you'll have to recalibrate it, because no two input channels are exactly the same, not even on the same scope! It always pays to check.

That should about cover all of the vertical controls on most scopes, with the exception of a few found on multiple-channel units. Next time, we'll get into those and the really fun part. Now, let's look at a letter.

Dear Kaboom,

What's the difference between a linear amp for FM/CW and one for SSB? Can I use a CW-type amp on 50-MHz SSB?

Signed,
Wanna Talk

Dear Wanna,

We hams have a habit of calling any big RF amplifier a "linear" amp. Unfortunately, not all amplifiers are truly linear. Those made for FM or CW don't have to be because the exact waveform, and its precise amplitude changes, don't carry intelligence. So, you can get away with lots of distortion and then clean it all up with a filter before you send it to the antenna. That's precisely

the technique used in walkies and CW transmitters, and not just because it's cheaper. It's also considerably more power-efficient. For AM and SSB, though, you need true linearity. That means that the output power of the amp must go up and down exactly in step with the input signal's amplitude changes. After all, those changes represent the modulation you want to transmit in the first place! The basic difference between the two types lies in how the power element, be it tube or transistor, is biased. A truly linear amplifier has enough bias voltage on the element that both the positive and negative peaks of the incoming signal are accurately amplified and not clipped off. So, if your amplifier is truly a linear amplifier, it should work fine on SSB. If you're not sure, try running it into a dummy load and listening with another rig. If the audio is horribly distorted, the amp will need some modification to be useful on SSB. By the way, you should never run an SSB amp anywhere near full power on FM, not because it won't work, but because the constant full power demanded by this mode probably will overheat and destroy the amp!

See you all next time.

RANDOM OUTPUT

Continued from page 88

round attendance figure. Let's be generous and assume that two-thirds of those tickets are paid at the pre-registration price of \$11 and only one-third are bought at the door for \$14. That's another \$360,000. There were 48 pages of advertising in last year's program book, at a round figure price of \$780 per page, so \$37,440 is the take on that.

Adding up the figures, we come to a very conservative income estimate of \$898,515. Since most of the staff working the hamfest are volunteers, the expenses are a lot less than they would be for another industry's trade show. Renting the Hara Arena, security, advertising, printing of tickets and programs and paying for some of the speakers' travel and lodging are the only major expenses.

As long as everything is on the up-and-up, I'm the last person on earth who would begrudge any person or organization from making as big a profit as they can (I'm a capitalist to the very core). I honestly don't care what happens to the profits, and frankly it's none of my business. Since none of that money seems to be spent on improving the conditions and services of the Hamvention, I simply wonder where it's all going.

What really put the icing on the cake for me was my dealings with the guy who ran the exhibitors' booths last year. After 73 had spent something like 20 years in the same spot, he wrote to me and told me that because

our check had not been received in time, we would not be able to retain the same booth space. In fact, after calling this gentleman, he informed me that he had already given the booth to another exhibitor, and he had already told the other exhibitor the good news. All the time, this gentleman assured me that the fact that our two booths, on the end of a row, has restricted them from forming a two- or four-booth "end cap" had nothing to do with 73 losing the space. Of course, you can probably guess what type of booth arrangement the new tenants were planning. Though it took many phone calls and some smooth talk, 73 finally got the booth, but it left a sour taste in my mouth. I'd rather not do business with a company that treats its customers so shabbily. I wonder if Kenwood, ICOM or Yaesu would have their booths taken away without so much as a courtesy phone call.

The unfortunate thing about all of this is that this year's booth chairman seems like a very professional and pleasant chap. In fact, I'm sure that all of the volunteers and club members who work the Hamvention are nice folks. If it weren't for reason #1, I probably would have given Dayton one more try. Nonetheless, after talking it over with Wayne, we decided that the liabilities of exhibiting at Dayton far outweighed the benefits. We'll rethink our decision from year to year, but I'm happy with what we're doing.

After all, would you be willing to pay a higher cover price or subscription rate, just so 73 could have a booth at Dayton? I thought not.

73

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Ham Doings Around the World

JUNE 5

NORWICH, CT The annual Ham Radio Auction sponsored by the Radio Society of Norwich, will be held from 10 AM until sold out, at the Waterford Senior Citizen Center, Waterford Municipal Complex. Bring your equipment to be auctioned. Talk-in on 146.071.67 rptr. Contact **KA1BB** at (203) 739-8016.

SOUTH BURLINGTON, VT Come to the South Burlington Middle School on Dorset St., to enjoy the Northern Vermont Mid-Summer Hamfest. Time: 8 AM-3 PM. VE Exams at 2 PM. Talk-in on 145.47 (-600) or 146.85 (+/-600). Contact **Joe Tymecki N1DMP**, (802) 893-6458 or **Mitch Stern WB2JSJ**, (802) 879-6589.

JUNE 6

CHELSEA, MI The Chelsea Swap & Shop, sponsored by the Chelsea ARC Inc., starts at 8 AM at the Chelsea Fairgrounds. Talk-in on 146.980-. Contact **Gary R. Widmayer N8AYY**, P.O. Box 325, Manchester MI 48158. Tel. (313) 428-9398.

MANASSAS, VA The Ole Virginia Hams ARC will sponsor the Manassas

Hamfest/Computer Show at the Prince William County Fairgrounds. Open to the public at 8 AM. Talk-in on the Manassas rptr., 146.371.97 and 223.06/224.66. Commercial vendors contact **Woody KD4DEG** at (703) 368-5180. For info, call **Mary Lou KB4EFP**, (703) 369-2877.

NEWINGTON, CT The annual Amateur Radio and Computer Flea Market, sponsored by the Newington AR League, will be held from 9 AM-2 PM at Newington High School. Guided tours of ARRL headquarters and W1AW. VE Exams (no walk-ins); SASE to **Susan Fredrickson WM1B**, P.O. Box 165, Pleasant Valley CT 06063. For info and Flea Market reservations, contact **Jim Carney KA1TAF**, c/o NARL, 34 Meadow St., Newington CT 06111; Tel. (203) 673-0884; (SASE for confirmation).

PRINCETON, IL The Starved Rock Radio Club Hamfest will be held at the Bureau County Fairgrounds, starting at 6 AM. Talk-in on 146.355/955. Contact **Mark Tondi N9OVD**, RRI Box 34, Peru IL 61354. Tel. (815) 446-4342; or **Nils Barto, Jr. N9PLJ**, 2238 Schuyler Dr., Peru IL 61354. Tel. (815) 224-1299.

JUNE 12

BANGOR, ME A Hamfest, sponsored by the Pine State ARC, will be held at the Hermon Elementary School from 8 AM-1 PM. Flea Market. VE Exams. Contact **Roger W. Dole KA1TKS**, RR #2 Box 730, Bangor ME 04401. Tel. (207) 848-3846.

LOVELAND, CO The Northern Colorado ARC will present "Superfest XV" at the Larmer County Fairgrounds, 700 S. Railroad. Open to the public at 8 AM. ARRL VEC Exams (call **Rick Hubbard WA0DDC**, (303) 353-3577). Talk-in on 144.515/145.115 and 146.251.85. For table reservations, contact **Orlin Jenkins K0OJ**, 2101 5th St., Greeley CO 80631; Tel. (303) 353-7094. For details, contact **John Schmidt NK0R**, 1001 King Dr., Loveland CO 80537; (303) 663-7581.

MARMORA, ONT., CANADA Eastern Ontario Hamfest, sponsored by the Marmora ARC, will be held at 9 AM at the Marmora Curling Club. Talk-in on VE3TZW 145.41/144.81 rptr. Info and table contact: **Paul VE3UUM**, (613) 472-3449.

WINSTON-SALEM, NC The Winston-Salem Hamfest/Computer Fair will be

held at Lawrence Joel Veterans' Coliseum Annex, 9 AM-5 PM. Talk-in on 146.04/64. Send SASE to **B.J. Honeycutt**, Winston-Salem Hamfest, P.O. Box 11361, Winston-Salem NC 27116. Tel. (919) 723-7388 (24 hrs).

JUNE 13

DARIEN, NY The Lancaster New York Hamfest, sponsored by the Lancaster ARC, will be held at Darien Center Fire Co., on RT 77 at RT 20. Talk-in on 147.135 +600, 146.550 simplex, and 443.850 +5. Contact **Nick WA2CJJ**, 5645 Genesee St., Lancaster, NY 14086, (716) 681-6410; or **Luke N2GDU**, 1105 Ransom Rd., Lancaster NY 14086, (716) 683-8880.

ERLANGER, KY The Northern Kentucky ARC will sponsor "Ham-O-Rama 93" at Erlanger Kentucky Lions Park. Doors open at 8 AM. Talk-in on 147.255+ or 147.375+ rptrs. For info, registration, contact **KC4FET c/o NKAARC**, P.O. Box 1062, Covington KY 41012. Tel. (606) 341-1213.

GRANITE CITY, IL The Egyptian RC will conduct its annual EGYPTIANFEST at the club grounds on Chouteau Place

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Rd., from 6 AM-1 PM. VE Exams will be conducted at Sanford Brown Business College, 3237 W. Chain of Rocks Rd. Please contact *Eric Koch NFOQ*, (314) 946-0948 for pre-registration. Talk-in on the *ERC-W9AIU* 146.76 rptr. For info, tickets, contact *Larry Wallon NZOP*, at (314) 524-3254; 524 Heather, St. Ann MO 63042; or *Bill Dusenbery N9OQK*, at (618) 345-7587; 1260 St. Louis Rd., Collinsville IL 62234.

STEVENS POINT, WI The Central Wisconsin Radio Amateurs, Ltd., will hold its 16th annual SWAPFEST at the University Center on the University of Wisconsin-Stevens Point campus, from 8 AM-1:30 PM. ARRL VEC Testing. Contact *Art Wysocki N9BCA*, *CWRA Swapfest Chairman*, 3356 April Ln., Stevens Point WI 54481. Tel. (715) 344-2984.

STOW, OH The Goodyear ARC will hold its 26th annual Hamfest and Family Picnic at Findfoot Lake Park near Akron OH. Flea Market from 8 AM-4 PM. For tickets and info, contact *William F. Dunn W8IFM*, 4730 Nottingham Ln., Stow OH 44224. Tel. (216) 673-8502.

WILLOW SPRINGS, IL Come join the fun at Santa Fe Park, 91st and Wolf Rd., where the Six Meter Club of Chicago, Inc. will hold its 36th annual Hamfest. Gates open at 1 AM. Talk-in *K9ONA* 146.52, or *K9ONA* 146.37/97 rptr. Order advance tickets from *Mike Corbett K9ENZ*, 606 South Fenton Ave., Romeoville IL 60441, or any club member. Dealers: For pavillion reservations, contact *Joseph Gutwein WA9RIJ*, 7109 Blackburn Ave., Downers Grove IL 60516. Tel. (708) 963-4922.

JUNE 19

CORTLAND, NY The Skyline ARC will hold their 11th annual Cortland Internat'l Hamfest at the Cortland County Fairgrounds from 7 AM-3 PM. VE Exams by reservation only. Talk-in on 147.780/180. Dealers contact *S.A.R.C.*, P.O. Box 5241, Cortland NY 13045. Tel. (607) 756-6550 eves. or weekends.

GRANDVIEW, MO The Dixie ATV Soc. will sponsor the Dixie ATV Hamfest from 8 AM-3 PM at the Grandview Middle School, 12650 Manchester. Talk-in on 144.34 MHz simplex. VE Exams. Contact *Steve Carroll WVOJ*, 200 Monroe, Belton MO 64012. Tel. (816) 322-4429.

MIDLAND, MI The 19th annual Midland Hamfest, sponsored by the Midland Community Center, George St. at Jefferson, from 8 AM-1 PM. VE Exams, walk-ins okay. Talk-in on Midland 147.00+. Contact *Bill N8LTR* at (517) 832-3053 for info. Send reservation payments to *MARC Hamfest*, P.O. Box 1049, Midland MI 48640.

JUNE 19-20

BURBANK, ALBERTA, CANADA The Burbank Campground will be the site of the 22nd annual Picnic sponsored by the Central Alberta Radio League. Sat. June 19th: Golf Tournament at 0730 hrs; Barbecue Dinner at 1800 hrs.; Flea Market. Sun. June 20th: Pancake Breakfast at 0800-1000 hrs. Many other events. Contact *Blair Heinzlmeir VE6BJH*, (403) 343-1655. Talk-in on

147.150 +0.600 MHz, or 146.520 simplex.

JUNE 20

CAMBRIDGE, MA The MIT Radio Soc. and the Harvard Wireless Club will hold their TAILGATE Electronics/Computer/Amateur Radio FLEA MARKET at Albany and Main Sts., from 9 AM-2 PM. Talk-in on 146.52 and 449.725 - pi 2A - W1XM rptr. Call (617) 253-3776 for details.

FREDERICK, MD The Frederick ARC will hold its annual Hamfest at the Walkersville Firemen's Carnival Grounds from 8 AM-4 PM. Talk-in on 147.06/+, 146.52, and 448.425/-. For info, write to *Frederick Hamfest*, P.O. Box 1260, Frederick MD 21702.

MONROE, MI The Monroe County Radio Communications Assn. will sponsor the Monroe Hamfest at the Monroe County Fair Grounds, M-50 at Rasinville Rd., from 8 AM-2:30 PM. VE Exams by pre-registration only. Contact *Fred E. Lux WD8ITZ*, 5742 Parkside Dr., Monroe MI 48161. Tel. (313) 243-1053.

SANTA MARIA, CA The Satellite ARC will hold its annual Santa Maria Swapfest at the Union Oil Picnic Grounds. Gates open at 9 AM. Dinner served at 1 PM. Talk-in on *WB6IYR* 146.34/94. Call *Rick Laird KB5OO*, (805) 937-8337, or write to *Santa Maria Swapfest*, P.O. Box 2067, Orcutt CA 93457.

JUNE 24-27

VICTORIA, B.C., CANADA The Friendship ARS of Victoria will sponsor the 3rd Internat'l Friendship Radiosport Games and Hamfest. Talk-in on 146.84 rptr., or 147.42 simplex. Contacts: Tel. (604) 370-4420; FAX, (604) 370-3750; Packet, *VE7KPV @ VE7VBB.#IS-LAND.BC.CAN.NOAM*.

JULY 3

LEHMAN, PA Come to the Luzerne County Fair Grounds, Route 118, to enjoy the 14th annual Wilkes-Barre/Murgas ARC Hamfest and Computerfest. Gates open at 5 AM. Talk-in on 53.61, 53.81, 146.52, 146.61, 449.825 PL82.5 Hz. For details, call *KA3A*, (717) 824-5724 days; (717) 825-3940 eves. For tables, contact *K3SAE - KB3GB*, RD#1, Box 214, Pittston PA 18643. Tel. (717) 388-6863.

JULY 4

HARRISBURG, PA A Hamfest, sponsored by the Harrisburg RAC, will be held from 8 AM-2 PM at the Bressler Picnic Grounds. Talk-in on 6.76/R or 52/52. Reservations contact: *Steve Gohat KA3PDQ*, (717) 938-6943.

SPECIAL EVENT STATIONS

JUNE 12

WALLINGFORD, CT Grand Lodge A.F. & A.M. of CT amateurs will operate *WT1R* 1300Z-2100Z at the Masonic Home and Hospital, to celebrate Grandmaster's Day. Operation will be in the lower General portion of the 80-10 meter bands. For QSL, send SASE to *Bruce Backer*, Box 5028, New Haven CT 06525.

JUNE 15-18

LONDON, ONT., CANADA The London ARC will operate *CJ3-LON* from a hot air balloon on one of the following evenings: June 15, 16, 17, or 18; and the morning of June 19th, to celebrate the 200th Birthday of London, Ontario. Frequencies: 146.52, 446.00 simplex, and *FSTV* 439.25 TX only. For commemorative QSL, send QSL and SASE to *Anthony Drawmer VE3-SOU*, 55 *Briscoe St West*, London N6J-1M4 Ontario, Canada.

JUNE 18-20 and 25-27

WASECA, MN June 1993 marks the 70th year that E.F. Johnson Co. has manufactured radio and electronic components. To celebrate this historic event, the Viking ARS will operate a SE Station using Edgar Johnson's original call-sign, *9ALD*. If it is unavailable, *WA0CJU*, the club call of the Viking ARS, will be used for the duration of the event. Operation will take place on all non-WARC bands from 160-10 meters using a mixture of AM, SSB, and CW. Send an 8 x 11 SASE for a QSL card and special certificate, or a letter size SASE for the QSL card. For more details, call the 24-hour-hot-line, (507) 835-6612. Send requests to *E.F. Johnson Co.*, ATTN: 70th Anniversary Special Event Station, P.O. Box 1249, Waseca MN 56093.

JUNE 19

SPIVEYS CORNER, NC Triangle East ARA will operate *AC4QD* 0300Z-1200Z, to celebrate the 25th annual Nat'l 'Hollerin' Contest. Frequencies: CW 7.135 and 21.405; Phone 28.335 and 14.260. To get a certificate, send QSL and SASE to *TEARA*, 209 N. Third St., Smithfield NC 27577.

YUMA, AZ The Yuma ARC will operate a Special Event Station in commemoration of the 50th Anniversary of the US Army Yuma Proving Ground. Operations will be in the 15 and 20 meter General, and 10 meter Novice phone subbands, from 1500Z-2400Z. For a certificate, send QSL and a 9 x 12 SASE to *Operator CBA or YARC*, P.O. Box 7077, Yuma AZ 85366.

JUNE 19-20

ARCADE, NY The Pioneer Radio Operators Soc. (PROS) will operate *W2CRY* from the Curriers, NY Railway Station, to celebrate the one millionth passenger carried by the Arcade and Attica Steam Railroad. Operation will be in the General SSB/CW 10, 15, 20, 40, and 75 meter bands with 2 meter "rail-mobile" operation on 145.390 MHz rptr. SASE to *W2CRY*, 9765 S. Protection Rd., Holland NY 14080, for a special QSL.

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Ocean Challenge

In 1853, the 200-foot clipper *North-ern Light* set the sailing record from San Francisco to Boston, 15,000 miles, in 76 days and six hours. Rich Wilson WA1BZE and Bill Biewenga aboard the 53-foot trimaran *Great American II* are trying to break that record.

In January of this year, the science coordinator of the Staten Island school district, where I teach, invited me to participate in Ocean Challenge with my ham radio classes. I was able to make contact with Lyon Osborn in the Boston home office. He was the telephone link with Bill and Rich once they set sail in January. He and I arranged for the initial ham radio contact to take place on March 26th.

A curriculum book was provided to us which included lessons about longitude and latitude, boat structures, weather, teamwork, geography, and communications. The children enjoyed the preparatory lessons on courage and perseverance. They were fascinated to learn that Rich has a severe case of asthma. He must take medication four

times a day. This is the reason that the American Lung Association is one of the sponsors of Ocean Challenge.

We spoke in class about what kind of personality characteristics we expected to find when and if we got our chance to speak with Rich. I explained to the children that three years ago Rich was the skipper of the *Great American I*, when he attempted the same voyage. On Thanksgiving Day in 1990 the boat capsized and was lost when a 50-foot wave swept over it during stormy seas. He and his co-skipper were lucky enough to be rescued that night by a cargo ship heading towards New Zealand. This has prompted many people to ask him why he would want to take the risk again.

For days prior to the contact, the children in my 6th, 7th, and 8th grade radio classes wrote down questions that they would like to ask Rich. There was a lot of good, creative thinking going on. I chose the best questions, and made arrangements for those children to stay after school for the prearranged contact on 20 meters.

When we finally were able to establish a contact with WA1BZE/MM we were all quite excited. Each child lined up at the rig to ask his or her question. One of my youngsters, Jordan



Photo A. Following the *Great American II* on a map was an activity the kids looked forward to.

KB2PYS, asked about the kinds of birds that they had seen. At the time of the contact they were 45 degrees west of Cuba. Rich is an extremely verbal

operator and he went into great detail about the albatrosses they had spotted in the South Seas. He described them as unique, graceful birds with wing

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spans up to seven feet. Rich also described the beautiful color of the sky and the sea and the prolific amount of flying fish they kept encountering.

One student asked about the most amusing thing that happened on the trip so far. Rich described how they had heard something tapping and scratching on the hull bottom, so he dove into the cold, dark sea where he discovered and removed a giant kelp. While in the water, he got hit right in the face by a flying fish.

Rich spoke at great length to my kids about the importance of pursuing a dream. In answer to the obvious question, "Why are you doing this again?" Rich said that once a person has a goal or a dream he must never give up trying to accomplish it, no matter what obstacles he has to overcome. In his own case, Rich received enormous support from his mother who constantly encouraged him in this endeavor. The fact that he had to provide for the circumstances of his physical disability made his story that much more inspiring.

Second and Third Contacts

We made contact again with the *Great American II* on March 29th and March 30th. We listened as Rich described to the children how wonderful it feels to be out at sea in the clean fresh air while he gazes at the beautiful expanse of water going into an azure-colored sky. He told us that his breathing problem was tremendously improved

because of the clean fresh air. On the second and third contact he answered questions about the differences in construction between this boat and the *Great American I*. He told us about the division of labor between the two men and what it was like to be one half of a two-man crew on a voyage of this duration. He told the children that every team needs a leader (at sea, the skipper) and a chain of command. Bill and Rich decide sail changes and strategic weather routing constantly. When on watch, Bill sails the boat his way, with the proviso that major changes/decisions must fall in the skipper's lap.

One of the most interesting discussions in our contact with Rich took place when I asked him to compare and contrast what he was doing with the work of the astronauts on board a space shuttle. My kids are very much involved with NASA's SAREX (shuttle amateur radio experiment) program. He pointed out many similarities that provided me with material for many follow-up activities and lessons for the class. The children were the ones who commented on how the astronauts and Rich both had a pioneering spirit and were willing to take great risks to achieve their goals.

We couldn't make contact with them after the 30th because rough seas required that they both concentrate on moving the trimaran forward without their attention being diverted. Rich said that although they had computers set



Photo B. Left to right: Mike, Brandy, Barbara and Mike did reports and wrote up questions to qualify to stay after school for the contact with WA1BZE.

up with satellite communications system, he counted on ham radio for his most up-to-date weather information and found that the support of hams along the route was invaluable.

As of this writing, they calculate at least another week before they dock in Boston. We'll all be watching with tremendous interest to see if they break the record. Rich has promised to make arrangements to visit our school and

meet with the youngsters he spoke with on ham radio. What other kind of classroom can you think of that could offer this kind of incredible experience to young people?

[Editor's Note: As we went to press with this issue, Rich Wilson and Bill Biewenga made landfall in Boston on April 7th. Their total time of 69 days, 19 hours, 44 minutes is the new San Francisco-to-Boston record.]

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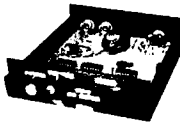


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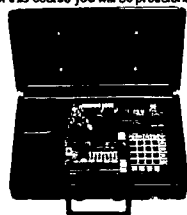


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Wrap-Up on the Controller Project

This month we'll wrap up some of the loose ends left dangling from our latest project.

There is a terminal block, available from Mouser Electronics (1-800-346-6873; stock number 506-8PCV-04), that fits the PC board and allows for easy connections between the array and the battery. Also, the trimmer used to set the state of charge is a Mouser number ME324-CP10H-470K. You can, of course, use other styles of trimmers, but they won't fit the board. The trimmer used to set the reference voltage is a 20-turn trimmer, also available from Mouser (stock number 594-64W102).

If you can't get the circuit to operate, the first thing to check is the reference voltage. No reference voltage or an incorrect reference voltage will produce a dead controller. By adjusting the trimmer, you should be able to

vary the voltage around the set point of 4.4 volts. Check for +12 volts on the input of the 7812. Also, check for +12 volts on the input of the LM317Z. If you've got that, then the trouble may be with the LM317Z. Be sure you don't have it installed backwards. It's easy to do with the TO-92 case style.

It's also a good idea to check for VCC on each of the chips. Remember, on the LM324, VCC is on pin #4; and on the 4001 it's on pin #14. Also, while you're at it, probe the ground pin. Being at ground, the pin should be zero. If not, then you have a soldering error on that chip. You may also have a broken trace on the PC board.

Double-check for the proper reference voltage on all points requiring it. Now, check for the proper function of the state-of-charge voltage. Adjusting the 470k trimmer should vary the voltage on the output pin of the op amp. If not, then you have either a wiring error or a bad section of an op amp. If you have the chip in a socket, swap it out with another one and retest the circuit.

Check to see if you have the required +20 volts on the gate of the

FET when the charging LED is on. If not, then you have either a bad 4001 or a problem in the voltage multiplier diodes. Use an oscilloscope and check the output of the oscillator. It should be a 2 volt peak square wave. Also, both of the control pins on the 4011 must be low when the charging LED is on. If not, then work back to the op amp switch. Swapping out an IC to find a bad op amp or gate is the best troubleshooting method for this section.

If everything seems fine but you still can't pass current, re-check the connections between the MBR1635 and the power MOSFET. Notice that the MBR1635 leads are backwards compared to most diodes. Some 1635s have a diode symbol to show what lead is what. See Figure 1 for a clearer view on how to connect the MBR1635 and the power FET.

You can expand the current capacity of the controller by increasing the current capacity of the blocking diode and the power MOSFET. An SD51 will handle up to 45 amps of current. You can add more power MOSFETs in parallel to increase current capacity and to lower the overall RDS(on) of the FETs.

Final Advice

First, this is by no means the best circuit in the world and there will always be room for improvements. I'm

not totally happy with the gate driver as it is not fast enough to fully turn off, causing some distortion. A better driver circuit would improve operation. Also, I noticed some of the harmonics from the voltage pump appearing on the gate of the FET. Adding a 0.001 cap from the gate to ground shunts this stray RF to ground, but it also adds extra capacitance to the FET gate. I'm working on a voltage pump using a small transformer to totally remove any RF from the system. Yes, there are special high-side driver chips on the market, but they're expensive and hard to get right now.

By breaking the connection from the 100k 1% resistor and the 20k 1% resistor from the PC trace you can use remote battery sensing. This point would then connect directly to the battery and not to the terminal block on the PC board. One more LM324 would give us low battery sensing, too, or perhaps a low voltage disconnect. Perhaps on the second generation I'll include these features.

I've noticed a bit of a bug every now and then in the over-temperature shutdown. I can't place my finger on it, but it looks like an offset problem with some LM324s. At very low battery voltage the over-temperature shutdown won't! As the battery's voltage increases, everything works as planned. I'm working on the problem.

The controller will work with a com-

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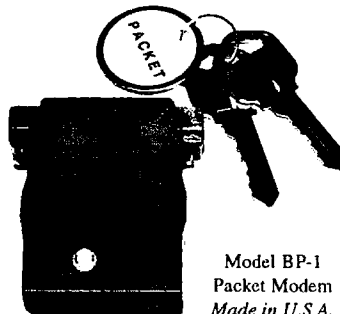


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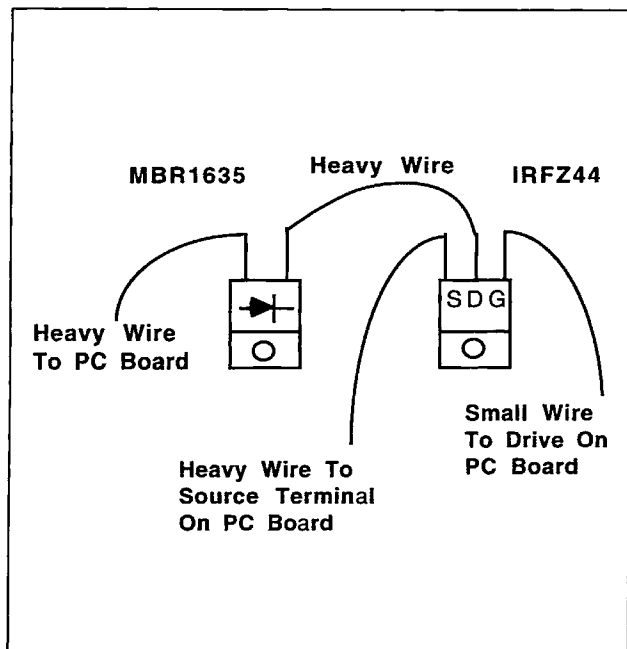


Figure 1. Connecting the MBR1635 and the power FET.

marcial power supply instead of a PV array. Just connect the power supply to the PV terminal and set its voltage to 16 volts. The supply should have current limiting, as a low battery may

draw more current than the supply can produce.

I presented the controller as a project to get one's feet wet with power MOSFETs. I hope everyone has

picked up a few ideas along the way. The market is always changing, and the power MOSFET is certainly not being left out. Today, the buzzword is 3.3 volt systems. Everywhere you look, you'll see a new specialized chip to work on 3.3 volts. The power MOSFET of yesterday required +10 volts to fully turn on. Now on the market are the newer power MOSFETs that you can saturate with TTL logic (+5 volts). The aim is to have a fully saturated gate with as little as 3.3 volts. The "on" resistance of the power MOSFET continues to fall. It's now possible to get "P" channel power MOSFETs with an $R_{DS(ON)}$ of less than 0.05 ohm. They're expensive, about \$19 each, but the price will continue to fall as more and more are made.

Even though the devices are rather rugged when soldered in the PC board, I've found that those with the lower RDS(ON) seem to be more picky about static discharges than FETs with a higher RDS(ON). I can't prove this theory, but all of the FETs I've zapped have been ones with a very low RDS(ON). So, when you're working with these devices, take time to avoid static discharges. Wear a wrist ground strap and use a grounded soldering iron.

You may also have some trouble locating power MOSFETs. It seems they're in quite a demand as a major component in the anti-lock brake sys-

tems used in today's automobiles. A number of times I've ordered IRFZ42s only to be told they're out of stock and back-ordered.

If you can't find all the parts needed for this project, drop me a line. I have most of the hard-to-get components in stock here. This includes the terminal block and the trimmer, as well as the power MOSFETs.

Coming Up . . .

In the coming months, I hope to have a working version of an amplifier based on N5NNN's version. I don't want to re-invent the wheel, but there will be some added features to this rig. Stay tuned.

Also, if you have built the little Two-Fer from two months ago, I'll be showing you a small self-contained T/R controller using a power MOSFET instead of the QSK circuit on the Two-Fer board. It will work in just about any home-brew QRP rig. I'm sure you'll find it interesting.

Of course, let's not forget that this month it's Field Day. Keep an ear open for me on 40 meters running home-brew gear this year. Solar-powered, of course, with battery backup at night.

Next month we'll look at some repairs to the very popular Ten-Tec Argonaut 509. Although it's a rather old rig by today's standards, it's still a QRP workhorse.

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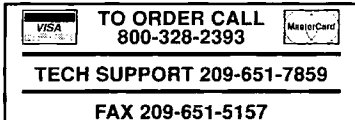
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Edge Of Space Sciences

One of the more prolific amateur radio balloon groups can be found in the Denver, Colorado, area. With over 100 members, the Edge Of Space Sciences (EOSS) group is a nonprofit corporation that promotes science and education via amateur radio and high altitude balloon experiments. They provide high school and university students with an opportunity to conduct scientific experiments at "near-space" altitudes in excess of 20 miles (100,000 feet). The EOSS group provides the transportation and balloon payload framework, and organizes the launch and recovery for these experiments. This is a great opportunity for all participants to learn how to design, launch and track what is for all practical purposes a small spacecraft (actually an "edge of space" craft).

Research and Education Possibilities

Students now have a chance to conduct a variety of experiments that were simply unavailable or unaffordable in the past, when they could fly their experiment either on the space shuttle or on a very large NASA research balloon. These options usually require a lot of lead time and the waiting list is long.

Through the efforts of the many members of EOSS, students now have a relatively easy and inexpensive way to study the atmosphere, environment and space.

EOSS has conducted over 11 balloon flights since its incorporation, all with extensive student involvement.

Gaining from their flight experience, they have developed a reliable system that relays telemetry (altitude, temperature, system voltage and experiment data) back to mission control through the use of an onboard flight computer that sends down the data via packet and CW. They usually fly an ATV system on 426.25 MHz, providing a live TV camera view of the earth, the balloon and the experiment. They can up-link commands to the payload to activate and control experiments, rotate the mirror in front of the TV camera, or release the payload from the balloon for recovery.

Their current system is called the EOSS "Shuttle" and is a reusable framework for downlinking ATV and telemetry (see Figure 1 for system details). EOSS has flown a number of flights using a standard weather balloon. Unfortunately, these balloons burst at peak altitude and the payload immediately parachutes back. Although very inexpensive, this type of flight usually lasts about two to three hours, and the time in near-space is limited to a short period.

To allow their package to float at altitude for extended periods of time, the EOSS group has been using a plastic "zero-pressure" style of balloon. Although more expensive than a rubber weather balloon (but not unaffordable), this balloon starts out at liftoff as a large bag of plastic with a small bubble of helium in the top (see Photo A). It is fully inflated at peak altitude and vents out excess helium until it reaches an equilibrium. It will stay at altitude until it loses excess solar lift. After sunset, it will start a slow return to earth unless ballast is dropped. One of EOSS's first flights using this type of balloon stayed up 18 hours and landed over 200 miles away, in Nebraska, around 5 a.m.! The dedicated (and

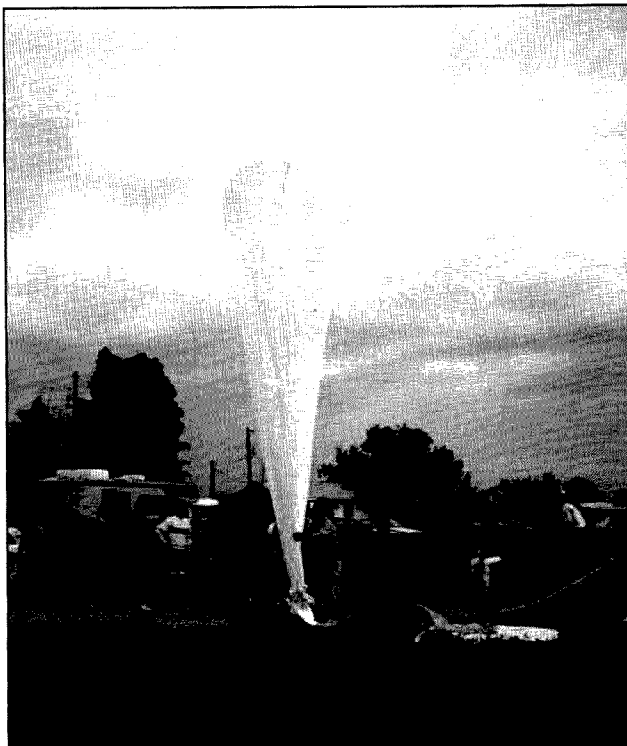


Photo A. The sixth EOSS flight used a large zero-pressure balloon to carry a student solar telescope aloft. It was dubbed the "Humble Telescope."

travel-weary) chase team had followed it through the night and quickly recovered it.

These long-duration flights have many possibilities. Imagine a VHF FM or an ATV repeater with a consistent 400-mile range! Some of the more advanced EOSS payloads have included a solar telescope, a Loran C position downlink and a gimballed mirror TV camera system to allow the ground crew to remotely control the view from the payload (downlinked via ATV on 426.25 MHz).

Their next mission will fly a student experiment which will test differential GPS (Global Positioning System).

National Balloon Symposium

In an effort to bring together members of the various balloon groups, educators, students and scientists to share information, EOSS is sponsoring the first ever National Balloon Symposium. It will be held at the Holiday Inn at the Denver International Airport (Denver, Colorado) from August 20-22.

Friday night will be a social event for viewing payloads and launch videos, and meeting the other attendees. On Saturday, papers will be presented by nationally prominent balloon experimenters, educators, scientists and authors. Topics will include such

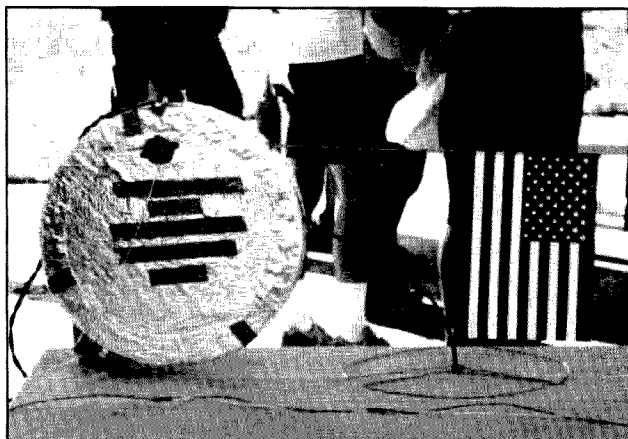


Photo B. The payload for the first EOSS flight carried a TV camera and ATV transmitter aloft. The flag was used as a rudder. (packaging by Dave Cllngerman W6OAL).



Photo C. During the tenth flight, this payload carried an experiment designed by university students.

areas as the general history of ballooning, payload construction and testing, flight systems, regulations, tracking and recovery, high altitude physics and plenty of tales and yarns about various flight experiences. EOSS will sponsor a luncheon at the Saturday meeting. A balloon payload workshop will be offered on Sunday, as well as (if the weather permits) an opportunity to launch and track an actual balloon experiment.

For information about the symposium, contact Edge Of Space Sciences (EOSS) at 376 West Caley Circle, Littleton CO 80120; Tel: (303) 794-5624.

To submit a paper for inclusion in the proceedings and/or for presentation at the symposium, please contact Ann Trudeau, 15487 E. Bates Ave., Aurora CO 80013; Tel: (303) 690-1669. Any group that would like to launch their own payload on Sunday from the symposium, please coordinate with Marty Griffin, 1647 E. Geddes Circle N., Littleton CO 80122; Tel: (303) 794-3458.

If you are interested in starting up your own balloon group or have an interest in this kind of amateur radio activity, this should be a fascinating event. Thanks to EOSS president, Jack Crabtree AAØP, for the above information.

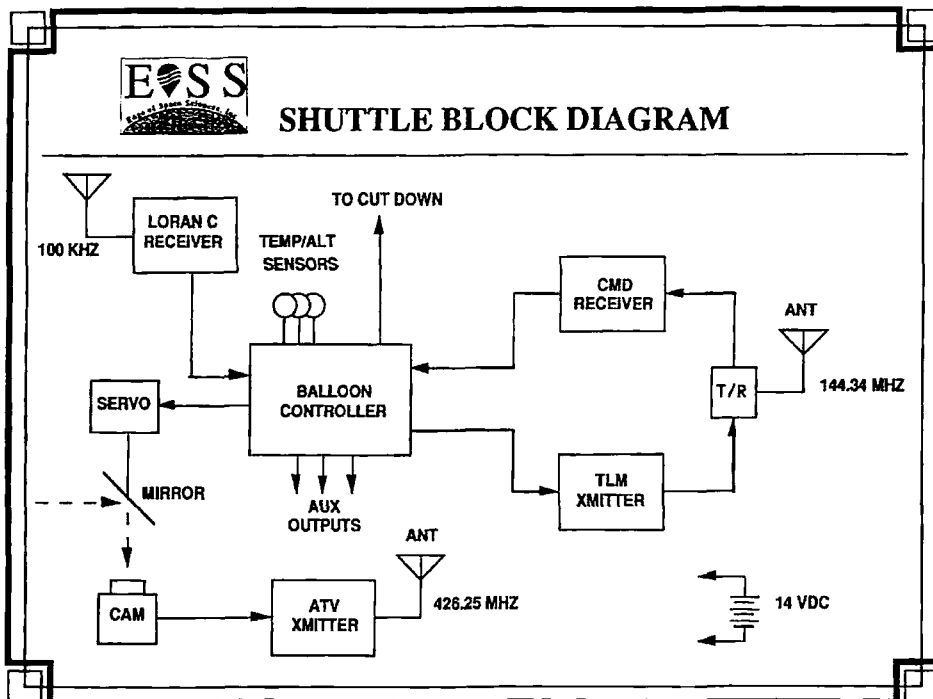


Figure 1. The EOSS "Shuttle" package consists of a reusable framework for downlinking video and telemetry from student experiments. Command capability is included via a VHF uplink.

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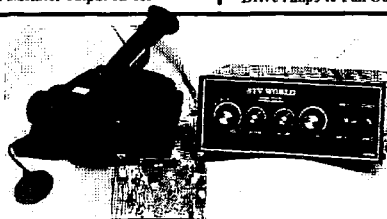
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Microwave Moonbounce

Microwave moonbounce might not be everyone's cup of tea, at least not those who think microwave communications is line-of-sight only (implying short distances only). Long-distance communications is quite possible on the microwave bands, and to prove it let's go to the extreme: moonbounce. This path covers communications of over a half-million-miles. Possible? Yes, indeed. As a matter of fact, communication was made between WA7CJO in Phoenix, Arizona, and G3WDG and G4KGC in England on 10 GHz moonbounce. What follows is the account from G3WDG covering this contact and some of the methods he used to make it.

"On January 31, 1993, at 2230, G3WDG and G4KGC made two EME QSOs on 10 GHz. This is believed to be the first made on this band from the UK. The initial QSO was with WA7CJO in Phoenix, Arizona, at 2230. This was the second attempt. The first test on Jan-

uary 30 was partially successful as WA7CJO was heard at good signal strength at G3WDG's location for a one-way contact.

"The antenna in use in the UK was a 10-foot solid dish (Andrew 11 GHz version) mounted on an E/Az mount originally intended for satellite TV use but modified for motor drive. The dish was scraped off from a local electronics company where G3WDG used to work. During Christmas 1992 the foundation was laid for the tower and a week before the first test the dish was put into its mount and the elevation azimuth drive motors were also installed.

"The rest of the equipment consisted of a Hughes 28 watt TWT amplifier. WA5VJB and KY7B helped in acquiring this tube and in refurbishing the power supply. The TWT was driven by a G4DDK-004 and a G3WDG-001-designed transmitting module for use in the 10 GHz system. An early design G3WDG-004 prototype HEMPT preamp was used to drive the receive converter, and a G3WDG-002 10 GHz converter was used in the 10 GHz converter. (Note: Designations such as G3WDG-xxx indicate different modules that are

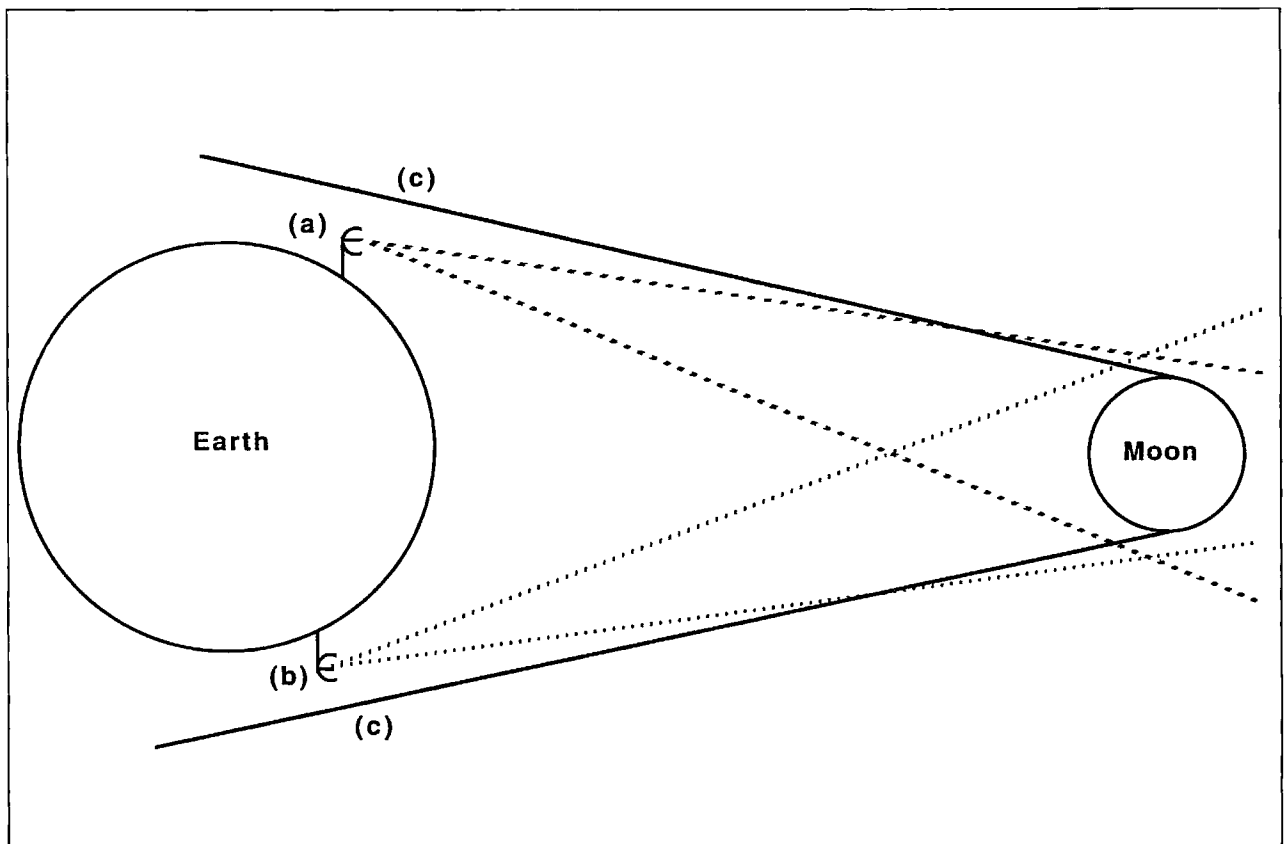
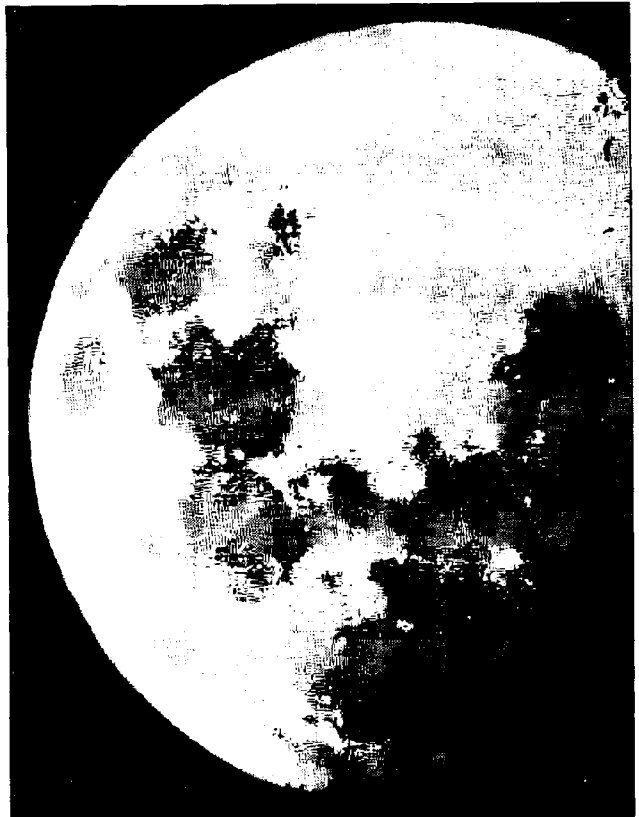


Figure 1. Basic EME moonbounce operation. Transmit and receive dish antennas are shown with a 1 degree beam width. Note: Reflected signal is much wider on return to earth. A = the transmit dish's beamwidth; B = the receive dish's beamwidth; C = the return bounce to earth.

available for 10 GHz construction in the UK).

"The output from the 10 GHz converter was split into two channels. One was fed into G3WDH's shack, feeding the 144 MHz receive system. The other feed supplied a 2-MHz-wide 70 dB gain block connected to an indicating power meter. The function of the power meter feed was to give visual indication when the dish was correctly aimed at the moon.

"The power meter was then used to read 'moon noise,' the increase in noise when the dish antenna is accurately aimed at the moon. The reference noise is that which occurs when the dish is pointed on nothing specific (cold sky). An increase in the residual noise reading on the power meter (when aimed at the moon) is a usable indicator that your antenna is in proper position for moonbounce work.

"In actual operation the moon noise measured 1.7 dB above cold sky noise at G3WDG's location, with a 1.25 dB noise figure preamp being used. A more sensitive (lower noise figure) preamp (0.75 dB noise figure) was not used at the time because it might be destroyed by the transmitting equipment. It was held in reserve for later tests.

"The standards for indicating signal readability on moonbounce signals are the 'O' and 'M' reports. These are standard EME signal reports: 'O' signifying easy copy, and 'M' difficult copy. In RST terms, G3WDG copied WA7CJO at 539, and later copied SM4DHN at 529. SM4DHN would have been 3 dB stronger if all stations were using the same polarization for the dish feed systems. Note: Both G3WDG and WA7CJO were using linear feeds; SM4DHN was using circular polarization.

"Signal reporting is done with 'O' and

'M' reports in CW; these are the standard EME signal reports used. I presume they use them because they are quick and easy to identify what is going on in a very fast action. When 10 GHz signals bounce off the moon they have a rough note similar to rain scatter, but not as rough. This is a CW signal with all the dots and dashes there, but with a rough note.

"It's kind of hard to explain this rough note. It is not pure CW as you hear on low frequency bands but, as I refer to it, a sort of a 'CUSH' sound. If you slur the word 'CUSH' the resulting noise resembles the returned CW note, with a short 'CUSH' being a 'DOT' and a long 'CUSH' being a dash.

"Back to the power meter and the tracking part of the system. The moon noise tracking method was recommended by WA5VJB and KY7B and it worked extremely well. With this system in place it was very easy to keep the dish exactly on the proper heading, despite the very narrow antenna beamwidth (about 0.7 degree). A sighting telescope had also been fitted to the dish mount but, as always happens in the UK, it was 100% cloudy on the 30th and 31st. The dish positioning had to be updated by reading moon noise on the power meter at least every minute to keep the dish in proper orientation, pointing at the moon.

"An alternative to checking dish aiming and system receive operation is to check sun noise. You guessed it! Cold sky noise is when the dish is pointing at nothing in particular. Sun noise is of course much larger than moon noise and whichever you use, both work well. The reports from the UK indicate that with the sun at a very low sun position they were able to get 3 dB sun noise

with the sun shining through a hedge."

Concerning the use of smaller dishes, Charlie G3WDG states that both WA7CJO and SM4DHN should be receivable on dishes smaller than his 10-footer. His calculations show that readable signals should be obtained with dishes as small 1.2 meters (that's four feet in diameter), with a very good low-noise preamp, of course. Charlie states that both WA7CJO and SM4DHN have quite good equipment: WA7CJO has a 5 meter dish and 350 watt output, and SM4DHN uses a 6 meter dish and 70 watts of power on 10 GHz.

Another interesting feature with moonbounce is that you do not need another station to be there to determine if you can successfully bounce signals off the moon. This can be verified by your own station. You transmit towards the moon and a few seconds later you should be able to hear your "echo" reflected back at you. Due to Doppler shift, the return frequency is not the same as your transmitted frequency, but is shifted higher in frequency. In this test from G3WDG he received the echo 14 kHz shifted in frequency. The signal was weak yet had quite consistent echoes, loud enough to have worked if it had been another station.

This should get you spurred up into thinking about EME contacts on microwave. Contacts of this sort are not limited to 10 GHz, but rather any band between VHF and microwave are possible. The equipment required is kind of specialized, but with a little scrounging you can put it together, if you put your mind to it.

EME Moonbounce Program

Path loss considerations need to be taken into account. The formulas are a

little bit intimidating, but there are many different computer programs available that will do the calculations for you. All you have to do is answer the questions prompted by the program and it will give you the needed approximations. I have a simple program that is good for beginners in this area as it allows you to play around with the different parameters to find out just what is needed to simulate moonbounce operation. A negative number indicates signals under the noise floor, and positive numbers indicate signals above the noise floor. The more positive, the better the chance of making the system work.

The program asks for simple data like the noise figure of your receive system (1.25 dB), receiver bandwidth (500 Hz), frequency in MHz (10368 MHz), Antenna 1 gain (10-foot dish = 45 dB gain, entered as 0.45), Antenna 2 gain (20 foot = 57 dB gain, entered as 0.57), and transmit power in watts (enter 28W, then let the program go). At the end you can select any one of the data points entered to re-calculate for custom designing. (If this sample data looks familiar it's because it's from the contact described above.) You can not only calculate its effects, but custom tailor the program for your special needs at other frequencies and station configurations as well.

This program is not new for me—it's something that I picked up in the early days of CPM and I found it on my old dinosaur computer (a Kaypro CPM machine from the early '80s). I take no credit for it and do not know the identity of the author or group who generated it. I'm just passing it along for your use. I have run this program on both CPM and IBM formats, using BASIC. This should

Continued on page 77

EME PROGRAM

```
100 REM THIS PROGRAM CALCULATES S/N RATIO OF THE EME SIGNAL
110 REM GIVEN THE EQ DATA FOR AVG EARTH MOON DISTANCE
120 REM AT PERIGEE SIGNALS WILL BE 1 DB STRONGER
130 REM AT APOGEE 1 DB WEAKER
140 REM NOTE THAT THE REC SENS MAY BE GIVEN AS EITHER
150 REM NOISE FIGURE (NUMBER, > 20) OR NOISE TEMPERATURE
160 REM OR ANT GAIN (ENTER AS GAIN/100). (IE. 9DB =.09)
260 REM GET INPUT DATA
270 GOSUB 350
280 GOSUB 370
290 GOSUB 390
300 GOSUB 410
310 GOSUB 430
320 GOSUB 450
330 GOSUB 480
340 REM SUBROUTINES TO GET INPUT DATA
350 INPUT "SYSTEM NOISE TEMP OR NOISE FIGURE *;N
360 RETURN
370 INPUT "RX BANDWIDTH (HZ) *;B
380 RETURN
390 INPUT "FREQUENCY (MHZ) *;F
400 RETURN
410 INPUT "ANT 1 DIA (FT) OR GAIN (DB) *;D1
420 RETURN
430 INPUT "ANT 2 DIA (FT) OR GAIN (DB) *;D2
440 RETURN
450 INPUT "TX POWER (W) *;P
460 RETURN
470 REM ANTENNA CALCULATIONS
480 D=D1 : GOSUB 530
490 G1=G : A1=D$ : A1=A
500 D=D2 : GOSUB 530
510 G2=G : A2=D$ : A2=A
520 GOTO 590
530 IF D<1 THEN GOTO 560
540 D$="FT" : G=(4.3422*LOG(5.094*D*D*F*F))-60
550 GOTO 570
560 D$="DB" : G=100*D : A=G
570 RETURN
580 REM CONVERT NOISE FIGURE TO NOISE TEMPERATURE
```

```
590 IF N<20 THEN GOTO 620
600 T=N : NS="K"
610 GOTO 640
620 T=290*(EXP(.2303*N)-1) : NS="DB"
630 REM CALCULATE RECEIVER NOISE POWER
640 R=-228.6+4.3422*LOG(T)+4.3422*LOG(B)
650 REM CALCULATION OF PATH LOSS
660 L=-271+8.684399*LOG(1296/F)
670 REM CALCULATION OF SIGNAL TO NOISE RATIO
680 S=G1+G2+4.3422*LOG(P)+L-R
690 S=INT(S/10)/10
700 REM PRINT OUT RESULTS
710 PRINT
720 PRINT "CODE    PARAMETER    CURRENT VALUE"
730 PRINT
740 PRINT "1    NOISE TEMP/FIG    *;N;NS$
750 PRINT "2    BANDWIDTH        *;B;HZ$
760 PRINT "3    FREQUENCY        *;F;MHZ$
770 PRINT "4    ANTENNA 1        *;A1;A1$
780 PRINT "5    ANTENNA 2        *;A2;A2$
790 PRINT "6    TX POWER         *;P;W$
800 PRINT
810 PRINT "SIGNAL TO NOISE RATIO *;S;DB"
820 PRINT
830 REM GET FURTHER INSTRUCTIONS
840 PRINT "NEW PARAM (1 TO 6), RE RUN (R) OR QUIT (Q);
850 INPUT AS
860 PRINT
870 IF AS="Q" THEN STOP
880 IF AS="R" THEN 270
890 IF AS="1" THEN GOSUB 350
900 IF AS="2" THEN GOSUB 370
910 IF AS="3" THEN GOSUB 390
920 IF AS="4" THEN GOSUB 410
930 IF AS="5" THEN GOSUB 430
940 IF AS="6" THEN GOSUB 450
950 GOTO 480
960 END
970 RUN
```


73 INTERNATIONAL

Number 24 on your Feedback card

Amie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

I had a great thrill on March 21! I had a chance to chat with Rick, Chief Op. for BY1QH and Ambassador to China, for about half an hour on 20 meters. Too bad the conditions were poor at the time, but there is always another day.

It's that time of year again for Field Day I plan to be actively involved with the KD1GJ effort in Keene, New Hampshire. I won't make it to Colorado for Field Day this year due to my teaching schedule for the summer.

Another story about hams, Silent Keys, and Field Day comes in a letter from P.J. and Ken Opfer, WB0MAL and WA0TOJ, friends from Gunnison, Colorado. P.J. relates a story about going to Fred and Fran Palmblad's house in Colorado Springs to take down a big beam antenna. Fred W0CYM became a Silent Key, and Fran said that the beam antenna should be put up on a hill somewhere where people could see it. The Gunnison Valley ARC felt that the beam should be put to use to honor Fred. They plan to use it during

their Field Day activities. Listen for the tribander on the air as W0GYV.

Have a great month and GET INVOLVED! 73, Amie, N1BAC.

Roundup

Anguilla Letter and Anguilla ARC Newsletter from John Rouse KA3DBN/VP2EBN: The newly elected officers of the Anguilla Amateur Radio Society (AARS) are: Dave Mann VP2EHF, President; Dorothea Mann VP2EE, Secretary/Treasurer; Larry Stott VP2EL, Government Liaison and Trustee for VP2EQ/VP2EA; Lou Bardfield VP2EB, Librarian; John Rouse KA3DBN/VP2EBN, Overseas Liaison and Awards Manager. DXers who operate from VP2E are encouraged to join AARS. For information contact KA3DBN at his Callbook address.

Generous donations from Angus Chassels (SWL) and Fritz VP2EY brought the cash needed to purchase a WACOM duplexer for the 2 meter repeater. By the time you read this it should be installed at the police communications facility with the "Super Station Master" located at the top of the 75-foot tower. Try it on 144.890 in/145.490 out (+600). A packet TNC set to the network mode and operating

on 145.010 MHz will operate at the same location providing island-wide connect capability for the VP2EA PBBS.

Jack Henry N6XQ has donated a turn-key 6 meter beacon to the AARS. Through the good graces of Terry Baxter N6CW/VP2ECW, Jack provided a modified Motorola radio with controller to give the world a Northern Caribbean area propagation beacon on 50.011 MHz. The beacon output is 50 watts; its callsign is VP2EA. [John Rouse KA3DBN, 2703 Bartlett Lane, Bowie MD 20715 USA.]

Chatham Island Downloaded from packet: A group of nine radio amateurs planned to be at the Chatham Islands from March 1 to March 9, 1993. They planned to operate under the callsign of ZL7AA. QSL information is ZL7AA, c/o P.O. Box 54, Hastings, New Zealand, or second choice, c/o ZL2AL at the Callbook address. Those who wish to QSL direct please send a self-addressed envelope with sufficient postage for return posting, otherwise all QSLs will be via the QSL bureaus in the respective countries. [Information forwarded by ZL2AMV @ ZL-BQK.#40.NZL.OC from details supplied by convener of the DX Group ZL2ARF, John Lane.]

Finnish Net/USA Downloaded from packet: The Suomi (Finnish) Net meets on approximately 7234 kHz, Monday, Wednesday, Friday, and Saturday at


10:30 a.m. EST. We welcome any Finnish-speaking hams to join us even if they don't have good linguistic abilities. It's lots of fun, and I'm sure you will enjoy it. 73 from Willie W8YNY, Crystal Falls, Michigan.

Honduras Downloaded from packet from Jorge Escotto HR2JAE @ W0XXK: If you have had contacts from HR stations without an answer, please send us your package certificate with the QSLs unanswered. Add an envelope for each one and do not forget the mail cost. Send to: U.R.E.H. Bureau, P.O. Box 73-73, San Pedro Sula, Honduras, C.A. Our bureau will contact those people and help them answer. If you have already sent IRCs or postage stamps, please advise us also. Many thanks from the Union de Radioaficionados Experimentadores de Honduras (UREH).

Japan From the JARL Newsletter: According to the IARU calendar, the Chinese Taipei Amateur Radio League (CTARL) joined the IARU as its 126th member as a result of voting by all IARU member societies.


CTARL was founded in 1991, and the number of its registered members at the time of application was 79. Mr. Tim Cheng BV2A/BV2B has been named president, and Mr. James Fang BV2BO director of its Secretariat. All correspondence may be addressed to CTARL, P.O. Box 93, Taipei, Taiwan.

Several dates to place on your cal-

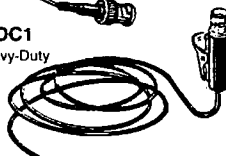


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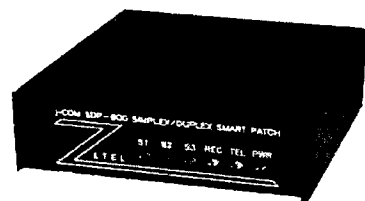
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endar are May 30th, the 35th General Assembly; August 20-22, 1993 Amateur Radio Festival; and October 31, All-Japan ARDF Championship.

The JARL received a Fax from the Chinese Radio Sports Association (CRSA) saying: "Opening of individual amateur radio stations has been permitted and the first such stations are to operate from 10 o'clock, the morning of December 22, 1992. The prefixes of their call signs are BA, BD, and BG." The stations will be set up and operated by none other than individual amateur radio devotees and used solely for self-training, mutual communication, and technological studies. Those desiring to set up a station must obtain permission from a nearby Radio Station Control Committee. Additionally, they must obtain a radio station license before actually putting the station to use.

Mongolia Letter from T. Naranbaatar JT1BV: Greetings to you from Mongolia from the president of "Descendants of Chinggis Khan" International Radio Club. The club was set up in November 1992 to immortalize the memory of Chinggis Khan (king) and his successors during the Mongolian Empire. Anyone can join our club. The club call sign is JT1V. We are pleased to sponsor several awards: Chinggis's Chronicle; Ugedei's Chronicle; Hubilai's Chronicle. For further information, either for membership or the awards, please contact us: Descendants of

Chinggis Khan International Radio Club, P.O. Box 106, Ulaanbaatar 51, Mongolia, Central Asia; Telephone: 32-84-02, 56-0-32; TLX: 79264 BUFAM MH; Fax: 976-1-310060.

Mozambique Downloaded from packet from ZS5S @ K2PPH: As of March 7, 1993, new call signs came into use in Mozambique and now conform to the ITU standard. John, ex-C9RJ, now-C91J, reports the new call signs recently assigned: C91-C96 will be the normal calls with C97, 98, and 99 for possible special events. It was proposed that C99 be used as a sort of Novice call (VHF privileges only). It is still not clear, but provision will be made for visitor operators and they probably will be authorized to sign /91. John also reports that the Department of Telecommunications in Mozambique is sympathetic towards amateur radio and is very cooperative. Radio classes have started recently and there are seven enthusiastic participants. 73 de Joe ZS5S, Sysop Aplink S. Africa. [HURRAH!—Arnie]

Russia Downloaded from packet, NT2X and WB2DHY: Russia is considering new guidelines for visiting foreign amateurs. Under consideration are: 1) RV7 call sign series to be assigned to foreigners; 2) Exams to be passed; 3) New paperwork, application with request from a Russian sponsor; 4) Some sort of fee will be instituted, in hard currency, for the license. All this is

in the process of development and nothing is firm at this time. I'll try to find out more and pass it on. 73, Ed NT2X.

Russia/Ukraine/Lithuania/Bulgaria Downloaded from packet: The popularity of communications with the ex-republics of the former USSR has prompted this list of packet bulletin boards: UZ3AXO.#MGU.RUS.EU, Moscow State Univ.; RS3A.#MSK.RUS.EU, Kremlin, Moscow; RK3KP.#MSK.RUS.EU, Moscow; UA6LU.RUS.EU, Rostov; UA6LQ.RUS.EU, Rostov; UZ9CWW.RU.S.EU, Ekaterinoburg (Sverdlovsk); UZ9OWD.RUS.EU, Novosibirsk Tech. Univ.; UT4UX.UKR.EU, Kiev; UB5LMJ.UKR.EU, Kharkov; U5WF.UKR.EU; LY2WR.LIT.EU, Vilnius; LZ2XA.BUL.EU, Sofia. Many thanks to KA2JXI and UA3CR. If you know of other BBSs in the former USSR, please pass them on to Dick N1MDZ @ K1RQG.ME.USA. NA.

Switzerland From the International Telecommunication Union (ITU) Press Release: Three new members have joined the ITU since the beginning of the year: Georgia, 7 January; Slovakia, 23 February; Kazakhstan, 23 February. As of 23 February, there are 176 members of the ITU.

BRAZIL

Carlos Vianna Carneiro PY1CC
Alonso Pena, 49/701
20270/240 Rio de Janeiro
Brasil

Well! We are having troubles delivering DX QSLs to the IARU Bureaus and we hope you'll accept our reasons, giving us credit for trying, for we are all rowing in the same boat.

Since 1934, when LABRE, the Brazilian Radio Amateur League, was formed, we have had a separate branch in each of our 28 states, with the LABRE managing the QSL Bureau. But, little by little, the expenses have been making it impossible to be managed by LABRE alone. LABRE's statutes were modified in June 1992 to pass the responsibility for delivery of QSLs to each of the branch organizations, a sudden nightmare for almost all of them. Because of the increased expense, each branch was certainly not ready to face this problem.

We are having no problem receiving DX or Brazilian QSLs; it is the return that we are having problems with. We're working hard to find our way out, and I'm sure we will, but please be patient.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel

Seventy Centimetres Under the Gun On January 12th, 4X6ZH, the IARC repeater coordinator, dropped a bombshell on the weekly IARC net. Isaac stated that far-reaching changes

The ears have it!



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73 Amateur Radio Today

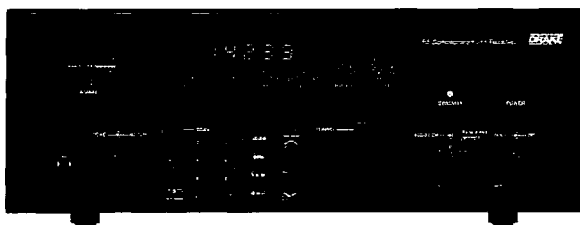
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are in the offing for our 430-440 MHz band (presently used on a shared basis, with amateur transmissions being on a secondary non-interfering basis). He said that we amateurs are in a STATE OF EMERGENCY insofar as 2 megahertz of the band are to be given away to the major two-way communications company in Israel for commercial use. Although there had been some vague rumors in the past, nothing had been stated publicly about the possibility of being dispossessed of some of our prime spectrum.

Although still under-used, with 2 metres fully occupied and all the Phase 3 and Microsat satellite activity utilizing 70 centimetres for up and downlinks, 430 MHz is prime real estate for near-future amateur activities, a very important part of our spectrum.

Then, just over a week later, the January IARC *HaGAL Magazine* appeared in our mailboxes. The published minutes of the September 13th (!) IARC Executive meeting let the cat out of the bag:

"Peleg (4X1GP) reports that the mobile communications (service) is in dire need of frequencies. The national frequencies committee (of the Ministry of Communications) appointed a sub-committee, and it recommended that 7 megahertz out of our UHF range be taken for the benefit of other elements. A sitting of the frequencies committee

in which Peleg was present turned down the recommendation and decided on the allocation of 2 megahertz for the mobile service and didn't state from where. The committee was instructed to hold a technical meeting to find a way to integrate the mobile service into the amateur allocation."

For years the Ministry had forbidden the hams to establish new repeaters on the 70 centimetre band. Activity has been mainly on the 438.650 Tel-Aviv and 438.800 MHz Haifa repeaters (input 7.6 MHz down), a few sparsely used simplex channels throughout the band, Ralph 4X1IF working moon-bounce and tropo on 432 MHz, and a smattering of satellite activity between 435 to 436 MHz by a handful of amateurs.

Now a sudden awakening has come, "Use It or Lose It," with plans for moving the old Tel-Aviv UHF machine down to Beersheva and a link for packet forwarding on 70 centimetres. The fact may well be that this is all too little and too late. There is a sense of outrage on the part of many hams and questions about what has been going on behind the scenes. On that same IARC Tuesday evening net when 4X6ZH "spilled the beans," one of our elected officials urged us not to discuss the matter on the air, but to wait for the IARC annual membership assembly on February 25th when all will be told. For

sure, there is now a vital issue at stake, and that get-together promises to be a hot one. [Does this sound familiar to the hams in the United States, the "taking" of 2 MHz of the 220-225 MHz band? Commercial interests, and money, talk! As Ron says "Use it, or lose it!" And there is no guarantee that even if we use it, we will not lose it.—Arnie]

OKINAWA JAPAN

David Cowhig J76CBQ/WA1LBP
AmCon Naha
FBU PSC 556, Box 840
FPO AP 96372-0840

In early November I made a short visit to Taipei (BV). The xiangchangzu "sausage tribe" of Taiwan now has grown from one to over 1,800 members over the last few years. Ham radio, personal radio, and a wide array of business radio services became available to the general public about three years ago when martial law ended. Who uses what frequency hasn't quite been settled yet. In one shop in the Pa Teh Lu electronic row an ICOM 2 meter handie was described as a CB radio and 144.800 MHz as the frequency used by motorists to exchange traffic information. In a second shop, a salesman said that businessmen buy ham equipment by day and hams buy it by night. In a third ham radio shop I met a self-described "underground ham" who talks with friends on 2 meters while he studies CW for the Taiwan ham examination. He told me that Taiwan has tens of thousands of unlicensed 2 meter operators. I see no trace of unlicensed operation on HF, though. All the BVs I have spoken to on HF from neighboring Okinawa are fine operators. Once Taiwan has adjusted to this revolution in radio availability, the number of licensed hams will certainly be far higher than it is today.

While in Taiwan I bought several issues of two Chinese language magazines which cover ham radio extensively. *Yeyu Wuxiandian* (CQ Amateur Radio Magazine), Shin Sheng Rd. Section 1, Lane 56 No. 12 fourth floor, Taipei, Taiwan, is published semi-monthly. The September 1992 issue discusses the Taiwan-Korea-Japan-Russia 430 MHz test in late July, the Taiwan 2 meter packet BBS network, the progress of the China Taipei Amateur Radio League founded March 1, 1992, the June 1992 annual amateur radio examination given in Kaohsiung (344 of 555 passed the exam), 10 pages of Japanese lessons for Chinese hams, Shane BV2FA's report on ham radio around the world, and an article by Lin Polung BV5AF on the WA7BML packet RBBS adapted for English and Chinese language packet radio in Taiwan.

The second magazine, 41-year-old *Wuxiandian Jie* [Electronics and Radio-TV Technic], Pa Teh Road Section 2, Lane 312, Number 19 Sixth Floor, Taipei, Taiwan, expanded its coverage to include ham radio. The November 1992 issue included ads for several

Taiwan brands of VHF and UHF handie-talkies such as Pro-Power and Union, a 200 watt output 2 meter amplifier with GaAs FET preamp from Aria, and several Taiwan-made ham antennas. Articles discussed radio propagation, antenna construction, frequency checking, how the Global Positioning System (GPS) automobile navigation systems work, setting up your first ham radio station, the Taiwan packet BBS network and its APLINK connection through BV5AF on 14.072 MHz LSB mark, basic transmitter principles, a four-page article about the radio-electronics inventors Russell and Sigurd Varian by Qing Shan, plus articles on SCR motor control, introduction to optoelectronics, railroad electronic monitoring and control systems, bar codes and bar code readers, digital image processing, remote control of PCs by telephone, a 10 mW QRP AM transmitter, and installments in series on elementary electronics and radio technology. This 160 NT (US \$6) magazine with its 150 pages of advertisements and 200 pages of articles reflects the robust good health of the Taiwan electronic industry and, incidentally, the role that ham radio now plays in Taiwan in training a new generation with a sophisticated knowledge of radio and electronics technology.

PEOPLE'S REPUBLIC OF CHINA

Rick Hunter, Chief Op BY1QH
Room 316, Building 25
Tsinghua University
Beijing 100084
People's Republic of China
Packet: BY1QH @ JA5TX.JPN.AS

More than 30 Chinese Amateur Radio Veterans spent a lovely day at BY1PK, the Headquarters of the China Radio Sport Association (CRSA), on January 20 in Beijing. Many of them were friends before 1949 and seeing each other again in this special place has turned out to be something quite exciting. Mr. Tong BZ1AA and Mr. Chen BZ1HAM were present on behalf of the CRSA.

TUARC has been honored by visits from many other hams. Some of those have been: Dieter DJ7BU, a German engineer at Siemens, with friends Meng BZ1FB and Ling BZ4ROM; Benny BV4HF, a 23-year-old medical student; Mr. Li Liang BY2SY and Miss Du Fan BY6NZ.

We have been very pleased with the response from many who have wished to exchange flags with us. We look forward to many more. We are now on the WARC bands using a Kenwood 440S and a ground plane vertical antenna. Sorry, CW on 12/17/30 meters is not available at this moment.

Our thanks to many who have sent us messages and talked with us on the air. Our continued thanks to those who pass this information on to the rest of the world via packet and magazines. What questions do you have? We would be glad to answer them for you.

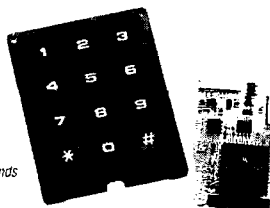
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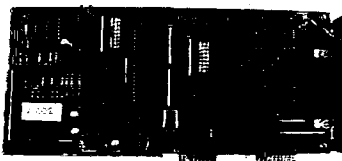
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ABOVE & BEYOND

give you some insight into just what is needed to pull off a moonbounce contact.

I hope you use this program to evaluate your typical station for moonbounce operations. It will give you a good idea of what is going on and will allow you to assemble your specific station requirements for successful operation.

Mailbox Comments

Ian Hunt of Bridgetown, Australia, questions the availability of the 10 MHz standards that I made available quite some time ago in this column. Ian, I am sorry to say that the oscillators were a bigger hit than I expected. They went fast and are now all gone. I even managed to pick up an "unheard-of" second bunch from the same surplus dealer who had the first; even these are gone. If I can find another bunch of 10 MHz oscillators of reasonable accuracy I will pick them up and let you know.

I wouldn't have even made the oscillators available if it hadn't been for Bill Brown WB8ELK—I just did not think that there would be any interest in them. However, Bill wanted high accuracy oscillators for an article covering modifications to a Heathkit frequency counter and had difficulty in locating them. Our connection was sheer accident. Too bad was not able to pick up a larger amount of the surplus oscillators. I'll

Continued from page 72

keep my eyes open and make you aware if anything shows up.

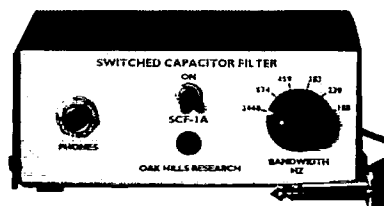
Joel K04AB inquired about the suitability of a Microwave Sensors, Inc. Model D8 microwave motion detector for 10 GHz operation (it uses a Microwave Associates MA86763 unit): "Is this unit suitable for 10 GHz operation, and do you know where I might find a surplus source for more of these units? Also, are the 30 MHz IF boards still available from you?"

Well, Joel, I haven't seen your particular unit but most of them on the market operate the same: power (DC) to the Gunn diode and connection of the detector diode to a suitable IF amplifier for receiving. All units are suitable for 10 GHz operation as they were intended for operation on 10,525 GHz for commercial operation. They usually have a frequency adjust screw allowing them to be re-adjusted into the amateur portion of the band. Also, the IF, a 30 MHz receiver PC board, is still available and the cost is still \$10 for the TDA-7000 and a PC board with a few parts tossed in. For a surplus source for microwave alarm units, check your local burglar alarm companies.

That's it for this month. As always, I will be glad to answer questions concerning VHF and microwave topics. Please send an SASE for a prompt reply. 73 Chuck WB6IGP.

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CopyCode from Sensible Software Solutions is a Morse code trainer for the Amiga computer that can be used to upgrade your amateur radio license. All controls—including frequency, volume, weight, character formation and transmission speeds, lesson length, and hide/show text—may be set by using a mouse. CopyCode contains all the characters on the FCC exam, and more. You can practice with the 14 predefined character groups or create your own groups using a unique on-screen keyboard. CopyCode contains thousands of random but repeatable sequences of characters, words, Q-signals, CW abbreviations and QSOs. You can also run multiple copies of CopyCode to practice receiving CW through QRM.

CopyCode is priced at \$23. For more information, contact *Sensible Software Solutions*, 4951-D Clairemont Square, Suite 262, San Diego CA 92117-2798; (619) 452-1938. Or circle Reader Service No. 202.

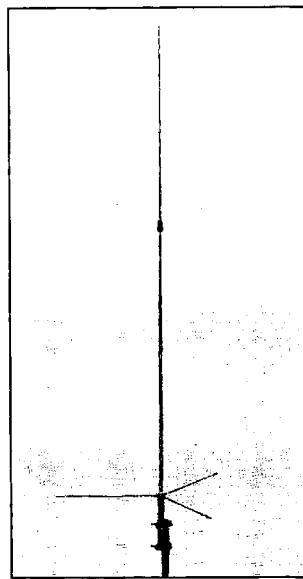
NCG/COMET

The COMET Model CX-333 Triband Base/Repeater Antenna, covering the 2m/220/440 MHz bands, is now available from amateur radio dealers nationwide. The CX-333 is a two-piece white Fiberglass antenna with an ABS screw-together connecting joint and compression washer for complete waterproofing and easy assembly. The overall length is 10'4", with a gold-plated SO-239 connector.

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For the price and more information, contact *NCG*, 1275 North Grove St., Anaheim CA 92806; (714) 630-4541, (800) 962-2611, Fax: (714) 630-7024. Or circle Reader Service No. 203.



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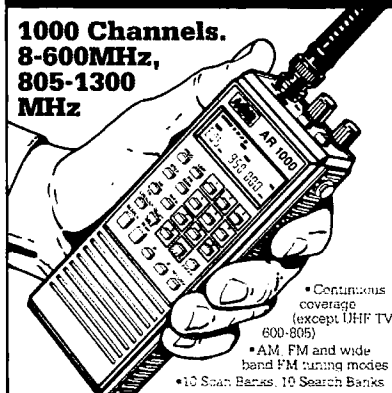
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Continued on page 82

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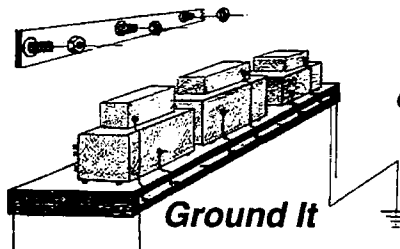
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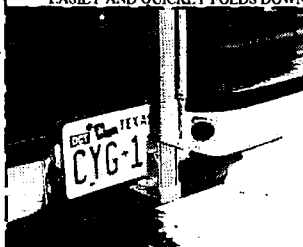


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CIRCLE 124 ON READER SERVICE CARD

NEVER SAY DIE

Continued from page 4

repair. It doesn't take much to screw up the DNA replication process, which is going on constantly as new cells are built and old ones phased out. The sharp wave fronts of CW square waves, which go from a few hertz on up into the microwaves, can't improve how our cells replicate and could help explain why hams have about double the deaths due to cancer as the general public. It might be worthwhile to find out if hams are any more susceptible to long-range illnesses than other people. When you mess up cells, you don't know what's going to break down. It could be more than cancer.

If you have a need for a reference guide to the published research papers in this field there are 21 pages of references on the 73 BBS . . . so far.

Cellular radios and cancer? I'll be amazed if there isn't a connection.

Me? A Bore?

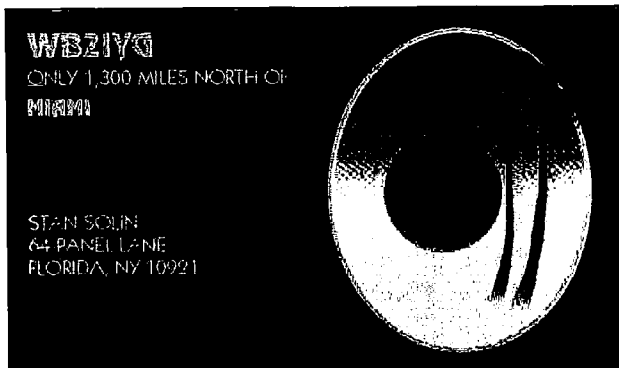
Forsooth! Well, I can be when faced with a contact with someone who just refuses to talk. Is it residual mike fright which has persisted for decades? Some of these non-talkers have some fairly old call signs. Is it that they've never done anything? Never read anything much? Never gone anywhere? Never really thought? No, I'm sure that if I could sit down with them I could pry some interesting stories out of them.

Many of the DX ops I talk with are bitterly critical of American operators. All Americans seem to want is a QSL card! Many American ops seem to have had their contact formula spiels frozen at around the time of their first contact. Well, it's a lot easier than having to think. Thinking, apparently, is hard work. Well, I suppose so. It's something which is battered out of us in school, where a thinking student is a teacher's worst nightmare. It's almost impossible to beat a habit mercilessly pounded into us over 16 years of school.

Our whole society is built around not having to think. TV provides us with endless semi-entertainment that seldom demands any actual thinking. Movies are geared to entertainment, not thinking. Most business is routine and thinking is punished when it interrupts the routine. Talk with friends is mostly blather, with no sign of thinking involved. Gossip. The reason *US* and *People* magazines were started is because too few people could cope with *Time* and *Newsweek*. The news magazines tended to call for some thinking, something Donahue, Oprah, and *US* don't.

A Cultural Straitjacket

The wonder is that a few American hams have managed to break free of this educationally and culturally built straitjacket and are able to conduct interesting, intelligent conversations over the air. The one-way nature of our contacts which, despite improvements in communications technology, we fiercely refuse to drop, makes it much more difficult to talk than a normal two-way



QSL of the Month

To enter your QSL, mail it in an envelope to 73, Wayne Green Inc., 70 Route 202-N, Peterborough, NH 03458. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to 73. Entries not in envelopes cannot be accepted.

conversation. I sure hope a few hams will start working on some practical duplex systems so we can make talking easier.

We can do this via frequency separation, so we can both transmit at the same time, or we might do it via time splitting, where we share a frequency but send sound samples several thousand times a second. This would allow us to have as many as six or seven people all talking on the same frequency at the same time to each other, with everyone hearing the others.

In the meanwhile, if those of us who are looking for more than a QSL card out of a contact can make a serious effort to get others to actually talk, perhaps in another generation we'll begin to see some results. We might establish some special frequencies for actual non-QSL contacts. Do you think there is any potential for conversational nets?

started pushing for a no-code license a few years ago and how amateur radio has gone to hell in a handbasket as a result of this accursed new license. Tell 'em how repeaters have screwed up hamming and I never should have promoted 'em back in 1969.

If you're short of mud to throw at me, I'll be glad to wet down your adobe hacienda so you can have more ammunition. Half of you will absolutely hate my pro-choice thoughts. The religiously overwrought will go bananas over my ideas on religion and have enough to talk about to keep them going for a generation. But hey, you've never asked me about God, Christ, Mohammed, Sri Krishna, Smith, Moroni, and Amee Semple McPherson. There are whole new fields of controversy to blow out of proportion.

We aren't short of groups looking for fights. There's feminism, homo-ism,

sions I have. This usually brings another letter telling me how stupid and opinionated I am. Sure, I'm opinionated, but at least I've done a lot of homework before arriving at my opinions.

Using Edison's definition of genius, mine is 99% perspiration and 1% inspiration. But you know, after the 99% perspiration, that little 1% of inspiration is very exciting and makes the perspiration more than worthwhile. So I keep buying books which are recommended as being worthwhile and reading them, highlighter always at hand. I keep a growing clip file of ideas from magazines. I find the most interesting people I can to discuss ideas. I'd love to run into you on 10, 15, or 20m and find out what you've done that we can talk about. But if all you're after is a crummy New Hampshire QSL you can go jump in a lake.

You probably aren't going to run into me during contests. I've done contests. I've done all the contests. I've worked all the countries I ever want to work, so I don't need any more QSLs. I've thrown out more certificates than 99% of you have collected, so I don't need any more certificates. No, when it comes to hamming, I mostly like to have conversations.

Oh, it's fun to make contacts via the satellites, even though some of them don't support long conversations. But having done that and earned a bushel of QSLs in the process, I don't seem to find myself driven to get my station set up again for OSCAR.

Satellite contacts are something I recommend everyone try. But the contacts tend to be more like a contest and after awhile the fun wears thin. Few of us other than true-blue DXers enjoy an endless contest.

Heck, after DXing from over 50 countries, I don't seem to be as interested in working the pile-ups from rare spots as I used to. Oh, that was tons of fun and I'll never forget one minute of any of my trips. But I've done that, and don't seem to be as readily volunteering for the hardship duty that goes with many DX-peditions. Besides, it's time I got you to get out there and have the fun.

Maybe you can practice up a bit before we make a contact. Maybe you can try to break that habit of not actually talking over the air. How about trying some contacts where you do not mention your equipment . . . not even your antenna. Keep your signal report to just readability. I do want to be sure you can hear me when we're talking. I'll bet you'll find this a serious strain on your ingenuity at first.

Remember, the more you get the other chap to talk, the more interesting the contact is going to be for him. He'll never notice that you aren't talking much, but are mainly asking him questions about him. All he'll know is that he's had more fun during this contact than he's had in ages.

However, when we contact you should do most of the talking. Remember, I've been sharing my joys and disappointments with you via my editorials, so now it's your turn to tell me about you.

"This usually brings a letter telling me how stupid and opinionated I am."

I'm not sure what the benefit is of nets where dozens to hundreds of ops check in to the net control and report they have no traffic. You can't talk with dozens of people. Oh, you can lecture them, but that isn't talking. Nets have the benefit of convincing thousands of hams that they're doing something. The upside of nets is that at least they seldom require anyone to think.

So? So what can you talk about? Well, if nothing else you might ask 'em if they've read the latest baloney in my editorials. I cover all sorts of topics, so you can rip me apart on about almost anything. You are always telling me that you don't agree with everything I write. Okay, put your big mouth where your pen is and tell the next chap you are in contact with what you disagree with and why. Tell 'em what you think of Wayne's pontifications.

I'm Stupid and Ignorant

Tell 'em you think I'm stupid and ignorant for suggesting that our public schools are destroying our kid's minds. Tell 'em what a lousy thing I did when I

cripple-ism, a wide range of religious fundamentalisms, a few political-isms. Oh yes, racism. So if we can't have intelligent conversations over the air, perhaps we can at least vent our bigotries and non-thinking prejudices, perhaps building up more steam than we can let off.

The upside of this is that when people get angry they louse up their immune system and are open to all sorts of both long- and short-range illnesses. Short-tempered people tend to be sicker and shorter-lived, so we don't have to deal with them for as long.

When you run into an angry, sarcastic person over the air you can sign off and change frequencies. But pity his family and business acquaintances who have to live with this poison! I get letters from angry people. Not many, but a few. That's natural because I write what I think . . . always with the proviso that if you disagree I want to hear why you disagree. Angry people don't have any whys, just vehemence. I often waste my time trying to answer their angry letters, explaining why I've come to the conclu-

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"Quickyagi" from RAI Enterprises is an inexpensive and easy-to-use yagi modeling/optimizing program that is both fast and accurate, and is used by antenna manufacturers, universities, government agencies and amateurs worldwide. "Quickyagi" utilizes a highly intuitive user interface with fully prompted functions, single key stroke menus, and scrolling highlight data access. Designed for nontechnical as well as technical users, it utilizes a unique auto-design function. The user only needs to input the desired frequency of operation, the number of directors, and the element diameter(s), and the program will automatically de-

sign and optimize a yagi, with a choice of optimum F/B ratio or optimum gain at the selected front-to-back ratio, while attempting to maintain minimum side-lobe levels. Other options include a bandwidth optimizer with a choice of wide or minimum frequency bandpass and pattern bandwidths. The auto-optimizing function may be used separately to optimize existing yagi designs.

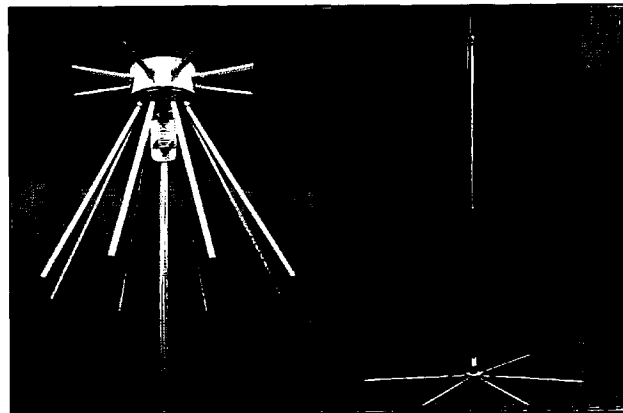
"Quickyagi 2.5" is priced at \$37, plus shipping and handling. For more information, contact **RAI Enterprises**, 4508 North 48th Drive, Phoenix AZ 85031; (602) 848-9755. Or circle Reader Service No. 205.

POLYPHASE CORPORATION

The second edition of *The "Grounds" for Lightning & EMP Protection* is now available from PolyPhaser Corporation. This expanded and updated edition contains 100 pages of information detailing the proper techniques for grounding and the protection of electronic equipment from the destructive energy of lightning and nuclear EMP. The publication's primary focus is on protecting radio communications equipment.

Other in-depth protection topics covered are: telephone, central office equipment, computers, local area networks, cable TV, TVRO, and security cameras.

This how-to-do-it publication is priced at \$22.95. For more information, contact **PolyPhaser Corporation**, Customer Service Department, P.O. Box 9000, Minden NV 89423-9000; (702) 782-2511. Or circle Reader Service No. 204.



FLYTECRAFT

FLYTECRAFT has introduced two new antenna models, the Model CFN and the SFX line. The Model CFN (left) is a 16-element, wideband VHF/UHF antenna designed for amateur radio operators or scanner enthusiasts, and for all frequencies from 50 through 1300 MHz. It provides a solid low angle of radiation or reception with a low SWR across the spectrum (less than 1.7 to 1 with unity gain). The Model CFN is designed for both indoor and outdoor use, and for permanent or portable use (to assemble, you simply insert the elements and tighten the screws).

The SFX line of monoband vertical

antennas (right) comes in five different versions for 40, 30, 20, 15 and 10 meters. These antennas are only nine feet high (the 10 meter model is seven feet) and are designed to sit on a patio, lawn or balcony. They can be set up or taken down in just a couple of minutes, and they are unobtrusive enough for antenna-restricted locations.

The CFN is \$119.95 (plus \$5.50 S&H); the SFX 40, 30, 20 and 15 are \$99.95 each and the SFX 10 is \$89.95 (plus \$6.50 S&H per antenna). For more information, contact **FLYTECRAFT, P.O. Box 3141, Simi Valley CA 93093**; (805) 583-8173, (800) 456-1273. Or circle Reader Service No. 206.

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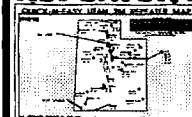
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CIRCLE 33 ON READER SERVICE CARD

David Cassidy N1GPH

Why We Were Not at Dayton

As I write this, the Dayton Hamvention is a week ahead. When you read this, the Hamvention will be six weeks in the past. (Kinda' like time travel, isn't it?) I can assume that there are several thousand of you who took note that, for the first time in almost 30 years, 73 did not have a booth at Dayton. Wayne and I were both there—Wayne to give his annual forum, me to walk around and bother people—but we did not have a display booth as we've always had.

I hope those who renew their subscriptions at Dayton every year were able to find one of the several thousand fliers we printed, offering the same deal that we would have offered in person. (If not, just send your Hamvention ticket stub, along with your renewal and \$15, to: 73 Amateur Radio Today/Dayton Subscription, 70 Route 202 North, Peterborough NH 03458. Do not send it to the regular renewal address.)

Many of you are probably curious as to why we decided to bypass Dayton this year. There are two main reasons.

Reason #1

We do not go to hamfests to make a direct profit. In fact, if you look at what it costs to attend a show, compared to the actual dollars we take in, you'd think that we lose a lot of money at every show we attend. Added to the cost of booth rental, air fare, hotel and meals, is the hidden cost of lost revenue. 73 is a pretty tight ship. We don't have enough staff to send to as many hamfests as we'd like. When I'm traveling to and from a hamfest, I'm not in the office and that can cost the company money in lost productivity. Even more important, every day that an ad sales rep is not in the office is a day of lost sales. I wish I could hire a few people to do nothing but travel to a different hamfest every weekend, but I can't.

Every day spent out of the office is a trade-off. Where the money spent on hamfests does pay off is in advertising dollars and public relations. Just being at the show puts us in front of subscribers and potential subscribers. This is good PR. Where the big money comes in is in advertising revenue. Hamfests are an opportunity to get face-to-face with our advertisers—to thank the ones who are regular advertisers, and to build a relationship with those who aren't, in the hopes that they someday will become advertising clients. We spend a lot of time on the floor of the convention, just saying "Hi" to our advertisers (and non-advertisers). We also work after the hamfest closes its doors for the night, going to dinner with potential advertisers, working out special promotions, or just socializing. Working a hamfest is usually at least a 12-hour day (and most of that is on your feet), but it pays off. Signing a single advertiser to a 12-month contract for a single page pays for the expenses of attending five hamfests.

The problem with Dayton is that it is so big that we don't get to spend any time with our advertisers. It is so

crowded that we don't have a chance to really talk to those who stop by the booth. All we can do is take their money and then say, "Next, please."

Dayton is so expensive to attend that there is no way we can make back the cost. Even though we sell at least 10 times the number of subscriptions we sell at any other hamfest, that revenue doesn't even come close to offsetting the enormous expense of attending. For what it costs to attend the Dayton Hamvention, I can attend five or six other shows, which is a much smarter way to spend an already tight budget.

Reason #2

The other reason we finally stopped throwing money down the Dayton hole is that the Hamvention is, in my not-so-humble opinion (as well as the opinions of many members of the amateur radio business community), the absolute worst-run hamfest of the year. Somewhere along the line, the Dayton Hamvention became a business—a big business—and yet it is still managed as if it were a local club event.

The price of a booth at Dayton is over twice the price of a booth at most major hamfests. What do you get for this overly-inflated price? Not much! You get to wait around for hours while the contents of your booth are delivered. You get to pay extra for such basics as a table skirt. You get to spend hours hunting down someone who can answer the most basic of questions. You get to spend the night at a hotel that is probably at least a 30-minute drive from the convention. You get to spend three days in a dirty, smelly and hot building that is nowhere near large enough to hold the number of attendees and exhibitors (every year I wonder where Dayton's fire marshal is). You get to pay extra to staff your booth with enough people to properly run it. You get to wait again on Sunday for the contents of your booth to be "checked-in" before you can leave. In short, after putting over a thousand dollars into the Hamvention coffers (and thousands more into the local economy), you get treated like your business isn't important. The attitude is, "We don't care if you're here or not, because we'll still make gobs of money without your business."

Spending of money, I've often wondered where all that money goes. There are 657 exhibitor spaces at Dayton. Each one of those spaces costs at least \$425. For some strange reason, Dayton is the only place I know of where a second booth space costs more than the first. For the sake of simplicity, let's say every booth sold for the single booth price. That's \$279,225 just for the inside booths. There are roughly 4,350 flea market spaces, each selling for between \$30 and \$50 each. Let's split the difference and say the average space goes for \$40. That's another \$174,000. Each one of those spaces has at least one person, and that's an additional \$11 each. Add another \$47,850. Paid attendance has been over 30,000 for several years, but let's use that as a

Continued on page 61

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

The HF bands this month are expected to provide a mixed bag of conditions. The summer solstice occurs while the sunspots continue their steady decline, as evidenced by the Solar Flux data given by WWV at 18 minutes past each hour.

You may expect the best days (G) on the 5th, 10th, 18th, and 30th . . . give or take a day or two. The worst days (VP) are likely to occur on the days from the 21st to the 27th, when conditions are very likely to be violently disturbed with active to storm conditions taking place in earth's magnetic field. Signal absorption levels are likely to be very high and DX poor to nonexistent. A full eclipse of the moon will occur on June 4th.

During the period between the 21st and 27th you may also expect some violent weather and other geophysical phenomena. Be aware of the possibility of a hurricane about that time. There may also be some possible earthquakes and volcanic eruptions around those dates. Although such a report is speculative in the extreme, keep a sharp lookout and let me know what you experience at your location. The first day of June is also likely to be very poor (VP) to poor (P), but conditions will rapidly improve.

On Good days and even Fair days you will find 10 and 12 meters opening out to 1,000-1,500 miles, with very high signal strengths and rapid fades, due to sporadic E-layer ionization. On 15 and 17 meters, you will find trans-equatorial DX on Good days with occasional openings on east-west paths peaking during the afternoon hours at your location. Remember, DX travels westward with the sun. The 20 meter band is likely to be the best DX band during June, with strong conditions on Good days to most parts of the world. Early morning and late afternoon hours are particularly favorable for DX, and you can expect short skip to be strong out to 500 miles or so during the daylight hours. The 30 and 40 meter bands will give

you excellent DX opportunities during the evening, nighttime and early morning hours on Good days, subject to thunderstorm QRN (which certainly can dampen your enthusiasm). Short skip will also be good on this band, often as far as 2,000 miles at night. Midnight DX to Europe and dawn DX to the Orient can be expected on good days. In general, 160 and 80 meters are not considered to be good bands during daylight hours due to excessive absorption of signals. Occasional DX openings may be encountered on particularly favorable nights, peaking toward sunrise, but high noise levels will tend to be discouraging in the presence of strong weather fronts (see Poor and Very Poor days).

Predictions and forecasts are both an art and a science, so your scribe can be very wrong or very right on occasion, but I'm generally "on the money," so please let me know how these forecasts work for you. See you next month . . . W1XU

EASTERN UNITED STATES TO:

GMT	00	05	06	08	10	12	14	16	18	20	22
ALASKA	-	20	-	-	20	20	-	-	-	-	-
ARGENTINA	20	-	-	-	-	-	-	-	10	1015	15
AUSTRALIA	15	-	-	-	-	20	20	-	-	-	15
CANAL ZONE	15	20	20	40	40	20	20	10	15	1015	1015
ENGLAND	-	-	-	-	-	-	15	15	15	-	-
HAWAII	15	20	-	-	40	40	20	20	-	-	15
INDIA	-	-	-	-	-	-	20	20	-	-	-
JAPAN	-	20	-	-	20	20	-	-	-	-	-
MEXICO	15	20	20	40	40	20	20	10	15	1015	1015
PHILIPPINES	15	20	-	-	-	20	20	-	-	-	-
PUERTO RICO	15	20	20	40	40	20	20	10	15	1015	1015
SOUTH AFRICA	-	-	-	-	-	-	-	-	15	15	20
U.S.S.R.	-	-	-	-	-	-	-	-	20	20	20
WEST COAST	20	20	20	40	40	20	20	10	15	1015	1015

CENTRAL UNITED STATES TO:

ALASKA	15	20	-	-	-	-	15	-	-	-	15
ARGENTINA	15	20	20	40	-	-	-	-	-	1015	15
AUSTRALIA	15	20	20	40	-	-	40	40	-	-	15
CANAL ZONE	20	20	20	40	-	-	-	15	15	15	15
ENGLAND	-	40	40	-	-	-	-	15	15	15	20
HAWAII	15	20	20	40	40	40	20	-	-	-	15
INDIA	-	-	-	-	-	-	-	20	-	-	-
JAPAN	15	20	-	-	-	-	-	15	-	-	15
MEXICO	20	20	40	-	-	-	-	15	15	15	15
PHILIPPINES	15	-	-	-	-	-	-	20	-	-	-
PUERTO RICO	20	20	40	-	-	-	-	-	15	15	15
SOUTH AFRICA	-	-	-	-	-	-	-	-	-	15	15
U.S.S.R.	-	-	-	-	-	-	-	-	-	20	20

WESTERN UNITED STATES TO:

ALASKA	15	15	20	20	20	-	-	-	-	-	15
ARGENTINA	15	20	40	-	-	-	-	-	-	-	1015
AUSTRALIA	15	20	20	-	-	40	-	-	-	-	15
CANAL ZONE	20	20	20	40	40	20	20	10	15	15	15
ENGLAND	-	-	-	-	-	-	-	-	-	20	20
HAWAII	20	20	20	40	40	40	20	-	-	20	20
INDIA	15	15	15	-	-	-	-	-	-	-	-
JAPAN	15	15	20	20	20	20	-	-	-	-	1015
MEXICO	20	20	40	40	40	20	20	10	15	15	15
PHILIPPINES	15	15	20	20	20	40	-	-	-	-	15
PUERTO RICO	20	20	40	40	40	20	20	10	15	15	15
SOUTH AFRICA	-	-	-	-	-	-	-	-	-	15	15
U.S.S.R.	-	-	-	-	-	-	-	-	-	20	20
EAST COAST	20	20	20	40	40	20	20	10	15	1015	1015

*1015 hours possible on good days only

JUNE 1993

SUN	MON	TUE	WED	THU	FRI	SAT
		1 P	2 P-F	3 F	4 F-G	5 G-F
6 F	7 F-P	8 P-F	9 F-G	10 G	11 G-F	12 F-P
13 P	14 P	15 P-F	16 F	17 F-G	18 G	19 G
20 G-F	21 F-P	22 P	23 VP	24 VP	25 VP	26 VP
27 P	28 P-F	29 F-G	30 G			

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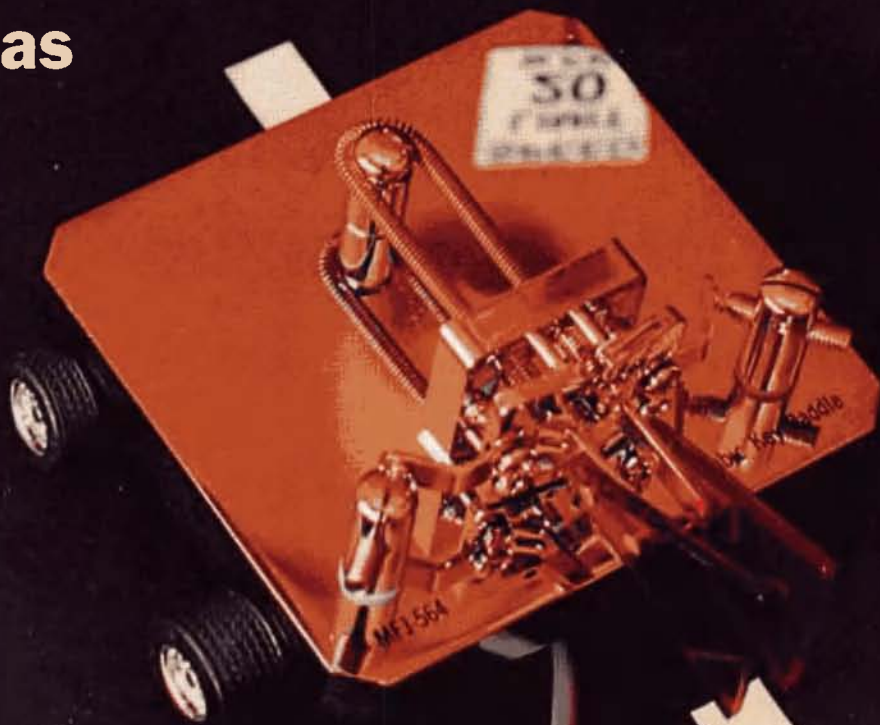
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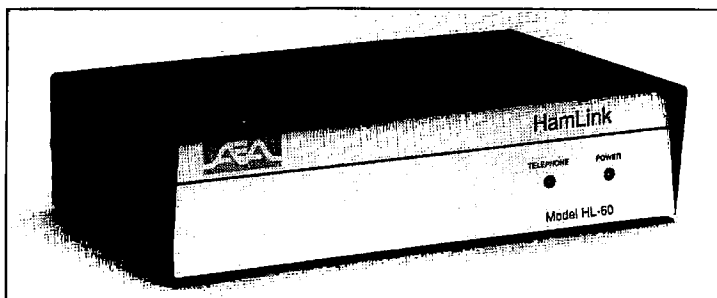
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Photo by David Cassidy N1GPH.

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NEVER SAY DIE

Wayne Green W2NSD/1



Eureka! I've Got It!

Unless your short-term memory system has been short-circuited by Alzheimer's, you should recall my grouching about the road blocks our stupid simplex communications system presents to those few of us interested in even attempting to talk about more than the weather or an endless recitation of our rig model and serial number.

Simplex . . . where we have to talk one at a time. Where the other chap prattles on endlessly, repeating everything three times . . . only "everything" turns out to be more like nothing. And where there's no way to break in and tell him "enough already." Or even interject an "uh-huh" now and then. Well, we'd sure save a bundle on telephone calls if they worked that way.

Duplex . . . where a person can enter into an actual conversation. It's no wonder we hams tend to talk about nothing over the air. We start out in life learning to talk using two-way instantaneous communications. We even have the advantage of being able to see the other person, which makes the use of hand gestures and body language enter into the communication process.

There was an entertaining squib on one of the recent TV magazine shows showing people animatedly talking on telephones in street phone booths. There was a great waving of hands and even arms as they talked.

Well, it's going to be awhile before we're able to organize duplex ham TV, bandwidth limitations being what they are, but I've thought of a way we can quickly get going with duplex contacts on our HF bands. Imagine being able to hold an actual conversation with a DX operator on 15 or 20m!

It's those contoured showers that do it to me. As I say, I've been grouching about this situation, asking you for a solution. So, there I was in Dayton, on the morning of the opening of the Hamvention, taking a shower. Bam! It hit me! Of course, the answer is simple.

Most of my really ingenious ideas come to me in the shower. My employees cringe when I come in to work and say, "Hey, while I was taking a shower this morning . . ." They know this probably means we're about to start a new business. Eyes roll. A lot of other

people have written about the same phenomenon. It apparently has something to do with negative ions. They have a positive effect. I've thought about putting in a negative ion generator, but one shower a day is all my employees can handle.

The problem we need to solve with simplex operation is the blocking of our receivers by our transmitter. No, we don't have to design new receivers which can unblock in a microsecond, we can do just fine with the receivers we're using right now. And no, I'm not talking about transmitting on one end of the band and listening on the other. For most of us that would still zap our receivers. Crossband? Well, almost. Now, if you'll stop trying to second-guess me and let me explain . . .

One easy way to be able to listen on your own frequency while you're transmitting is to separate your transmitter and receiver by a mile or two. Did that light up anything for you, or do I have to go into the detail? Let's pretend that you have a ham friend a couple miles away. It could happen. And let's just imagine that you might be able to work out a deal with him so that the two of you could operate at different times and use each other's rigs. All you need is either a telephone link, which isn't expensive, or a UHF link, which also isn't expensive. My choice would be 10 GHz for the link. We've got 500 megahertz up there sitting totally unused . . . a sure recipe for its loss, if the FCC ever gets short of frequencies.

10 GHz transmitters are a cinch to make. And all it takes is about a tenth watt to work anywhere you can see. A few years back WA1KPS knocked together a pair of 10 GHz transceivers in boxes about half the size of a half-gallon milk carton. The antenna was a small horn coming out one side. With these we racked up a seven-state contact record. I worked him in seven different states and Chuck worked New Hampshire seven times.

With a radio or telephone link we can "ventriloquize" our voices by a mile or five and thus be able to listen on our own frequency while we talk. Or any other frequency, if we want to work split-channel. Of course, if you both want to operate at the same time then you'll have to go back to simplex

until the urge passes. I'll bet that once you get used to duplex, going back to simplex will be worse than watching TV on a small black and white set with a rabbit-ear antenna.

Yes, I know . . . both ends of any contacts will have to be set up with remote transmitting to make this work. So, we'll have to start setting up some special frequencies for duplex pioneers to meet. I'm open for suggestions. 14.313? Sure, why not. No one is using that frequency right now. It's about time we put it to constructive use. We could start in the 14,300-14,320 kHz part of the band and gradually expand. When SSB first got going it was started at the top end of 20m and gradually moved on down the band, squeezing out AM until it was all gone.

We're already seeing some sophisticated devices for remotely tuning our transmitters and even swinging our beams. If we can get duplex into action we'll see a lot more of these magically appearing in our ad pages as entrepreneurs get into the business. Eventually we'll start seeing remote control circuits built into our transceivers.

You say this must be illegal? Go soak your head! With sideband we have no carrier, so when we're listening we're not transmitting. This is perfectly legal.

Please let me know when you get set up for duplex so I can pass along the news in 73, thus encouraging others to get off their fat butts and get set up so they can talk with you.

The downside of all this is that after all these years of having never said anything of significance during a contact, are you going to be able to actually talk with people? Can you hack that? This may take some getting used to.

Remotely controlling the rig is a snap. Over 20 years ago I hooked up a spare Standard Radio 2m repeater to my 20m rig so I could operate it from anywhere in town. I was into morning mountain climbs up Pack Monadnock mountain, so I'd take along my little HT and talk with 20m ops all around the world while I got my daily exercise. It sure took the boredom out of the walk. Then I took the repeater over and set it up in Amman as JY73 . . . and left it there, along with

a suitcase full of HTs. I remember saying good-bye to King Hussein via the repeater as I was boarding the plane heading for Cairo and then home.

So, once freed from the tyranny of simplex, what are you going to talk about? Your rig? The weather? Cocktail party chit-chat? Can you stick to something you actually know about or are you going to get off into deep water with things where you have to substitute intuition and belief for thought? There's a lot of that going around.

The Biggest Change Since Repeaters

It's about time we got something new going. In the late '50s we got going with sideband. In 1969 we started with repeaters, which by 1973 became the largest activity in the hobby. In the 1980s we got interested in packet, but this hasn't been the grabber we had with sideband and repeaters. Perhaps in the '90s we can make duplex our new pioneering effort.

I can see clubs setting up HF transmitters at their repeater sites so club members can access the system and take advantage of the site and the distance from their home operating position. I've got a great hamshack location in Hancock (NH), complete with a tower and beam. I'd love to get it set up so anyone able to access the W2NSD/1 repeater could use this as a remote transmitter. I even have a repeater all set up we could use for the project. With some of today's rigs we should be able to remotely change bands, tune any frequency, and swing the beam. We might even figure out how to allow several ops to use it simultaneously so three or four could chat with South Africa just like they were all in the same room.

If you like the idea and try it out, this is an invitation to write about it. I'd like to see articles on control systems and reviews of any applicable commercial products. 73 helped sideband grow in the '60s. It helped repeaters grow in the '70s. We even helped packet in the '80s. Can we do it again with duplex? I think this could be the greatest thing that ever happened to amateur radio.

If any manufacturers are interested in working with us on this project I'd like to hear from them. Once we have something going I'll be devoting a good deal of space in 73 to the project. This will also give us something exciting to tell the general public. Yes, I'll be doing videos and getting them on TV stations wherever possible.

If we're going to keep our bands we've got to do a whole lot more than we've been doing to hold our franchise. We need to figure out how to attract youngsters by the millions, not by the dozens. We need to sell amateur radio and school radio clubs as a way for America to build the high-tech work force it must have to compete in the world of 2000 and 2020. The last thing we need is some 2020 hindsight telling us what we should have done in the 90s.

Continued on page 86

From the Hamshack

Greg Smith N8PPZ, West Carrollton OH Wayne, thank you for getting me up off my duff and upgrading. Thanks to you I finally passed the 5 wpm code test after taking it several times and failing because I procrastinated and did not really spend enough time studying. It's your fault that I am now a General, that I just couldn't stop, and I blame you, sir, for the fact that I am now trying to pound the Advanced theory into my head. Before I insult you too much, I just want you to know that I now see a reason to go on and get my Extra Class: because I WANT TO! Maybe I am foolish to think that the conversations on the lower bands are more interesting than they are on 10 meters and VHF. I am tired of an endless string of signal reports and 2 meter drivel. I guess it is too much to hope for (call me a dreamer), but I'll probably call you every name in the book if I find out that all other hams want are signal reports and QTH.

On a happier note, I did write to you before and what you wrote back caused me to do the above and more. I have now founded the Sinclair Community College club, and it is going well. I got a promotion at work, and in addition to operating a three-camera robotic studio camera system I am doing news writing and some assignment desk duties.

Last year at Dayton I talked with you and mentioned an idea about a new business. I guess I spoke too loudly because somebody else used my idea and started VIDEO ELMER. I lost out, dangnab! I had to think of something else, and I did. I sent out on the national ham radio echo on Relaynet a series of essays I called "How To Fix a Nation." These contained my ideas for fixing our miserable schools and ending the problem of teen violence. Unfortunately, I found out just how much other people think about these problems. People are too status quo and passive. I guess they just need somebody to give them a swift kick in the right direction.

Jeff Carter KK6RY, Simi Valley CA I agree wholeheartedly with you concerning the public school situation. I might also add that I agree with your attitude concerning the ARRL. I am a past member who opted not to renew. I decided to do this for a couple of reasons: one, the whole no-code fiasco; and two, the fact that I do not believe we are being represented in the most efficient way in Washington, DC, by the powers that be. If the ARRL is supposed to be our "mouthpiece" in FCC affairs and all the other political rot that goes on at Capitol Hill, then they are utter failures . . . If

we are to save frequencies from further degradation to commercial interests, we must put the technical-minded nature of the hobby back in the forefront and stop this selling out to the "big gun" commercial interest groups and others with their fingers in the spectrum pie. Next time there is an earthquake, fire or flood of disastrous proportions, let the dummies call UPS, their tow truck company, or any other VHF and above user for help! I think you get my drift.

As a VE, I have also seen the mess with the licensing system. I have turned in my badge, cut in two, and told the ARRL to stuff it. With the no-code situation thus promoted, all we have accomplished is a mass flooding of the system with a bunch of handle-talkie-wielding appliance operators. Sorry Wayne, I don't buy it! This strength in numbers jazz just doesn't cut it for me. Yea, I know, technology marches on and all that stuff . . . but I, being an ex-USCG radio man in the '70s, well realized the value of CW for daily and emergency communications. I don't like the "slighting" I see of this mode of communication. I am an avid QRP nut and also a member of the Society of Wireless Pioneers and believe in the preservation of CW and older radio history. Let the no-coders run the local bicycle races and show off with their \$500 handle-talkies. I'm not impressed. I'll stick to my 2 watt CW rigs, which I built myself, and take pride in my operating practices. To each his own, they say, but I don't care if I ever get on an FM repeater again. The trashing of VHF/UHF will end up ruining it for us all.

Dan R. Cation WB0SHN, Savonburg KS Wayne, I am writing in response to two letters that recently appeared in 73 Magazine. Both mentioned traffic radar and the allegations that its use may cause cancer. I would like to take exception to the first letter from Mr. Beegan in the February 1993 issue and to your personal comment that appeared following Mr. Mayer's letter in the April 1993 issue stating that " . . . there is plenty of evidence (facts) that prolonged use can cause serious problems for officers . . ." I would also like to thank Mr. Mayer for his comments.

First of all, to set the records straight concerning the lawsuits mentioned by Mr. Beegan, out of 13 lawsuits filed against Kustom Signals, nine have been dismissed for various reasons before ever even getting to court. One has made it to court and I'm sure that the plaintiff would have liked to speak to you before going to court . . . they lost . . . by the unanimous verdict of eight jurors, after about three hours of deliberation.

Just to let you know where I'm coming from, I am not a self-proclaimed microwave expert or anything like that. What I am is one of the proud employees of Kustom Signals, who has worked for them for over 18 years. No, I don't work on the radar products. I am not a member of management or an engineer. I am currently an engineering technician and have worked as a technician somewhere in the plant for those 18-plus years. You would think that if one officer using one radar a few hours a day could cause cancer, then the technicians who test these radar units (currently around 25 units a day, nine to 10 hours a day, four to five days a week) would see some ill effects. I personally know one technician who has been doing just this . . . for close to 20 years! Kustom is very proud that it has many long-term employees who, like myself, have been sitting around in this steel building in Chanute, Kansas, for 10, 12, 15, 18, and even 20 years and longer with these "KILLER" microwaves bouncing around us. Guess what? There hasn't been one case of cancer or any other strange unexplained illness in any of Kustom's employees.

We are a small, privately-owned company of a little over 100 employees. We are not some corporate giant. These lawsuits nearly cost us all our jobs, in an area where there are very few jobs available. They did cost some of our co-workers their jobs (in a layoff) and caused the company to take such belt-tightening measures as going to a four-day work week just to keep the company going and to be able to defend ourselves against these allegations. We still have at least two more lawsuits to defend ourselves against. I would like to know where these "facts" that you speak of are. We sure haven't seen any from any reputable sources yet. By the way, I haven't seen any melted hood ornaments or dead birds from our radar, either. And, as one of our co-workers who recently retired (in good health) put it: Hell No, We Don't Glow!

Thanks to Mr. Mayer for his realistic point of view.

Dan—Thanks for your letter . . . I can understand your concern.

If successful lawsuits were a measure of dangers, that would be positive proof that cigarettes pose no danger to health. The asbestos industry fought the same battle for years . . . successfully. Now the power companies are also fighting the same battle against scientific research.

I don't doubt that you haven't seen any proof. But then I doubt that you have made any effort to look. Have you accessed the 73 BBS yet and gotten a download of a list of the scientific papers in this field? The list is over 20 pages long and growing every week. I just got in a new stack an inch high from the leading researchers.

The damage these fields are doing is insidious. There are a few exam-

ples of the extremes, but the research scientists are just beginning to understand the lower level effects. How much do you know or have you tried to learn about how the cells of your body function and communicate? And what happens to you when this communication is interfered with by a radio or magnetic field?

Have you seen any of the videos of police officers who have gotten repeated brain tumors right in the area where their radar antenna has been blasting their heads? Now we're starting to see the same thing happening with cellular telephones which are operated close to the head. But do you really think that a field which can do that to heavy users isn't doing anything at all to lighter users?

Not that I have much compassion for traffic radar manufacturers. Have you any research reports which show that the use of traffic radar significantly saves lives? There are endless reports showing that police radar is a major source of funding for towns, but that seems to be its use. Most accidents happen at low speeds. Higher speed accidents tend to involve alcohol.

Studies show that, lacking speed limits, people tend to drive at the speeds they are most comfortable with and thus the accident rate is lower than when speed limits are imposed. The research reports on this have been cited in the car magazines for years . . . as have the absence of refuting studies.

Your product is probably only actually killing a few dozen police officers a year, so this danger has probably been blown out of proportion. That's a reasonable price to pay for the income radar guns bring to towns. It's a good trade-off. As we find out what the less-than-lethal doses are doing to people, we can re-evaluate the product in terms of its benefits to society . . . Wayne

N. B. Sadorian N6WGX, Montebello CA It was a great surprise for me to see my request for information on Motorola's amplified speaker model number 2005B printed in your "Ham Help" column (February 1993).

You will be pleased to know that I am one of those who reads your magazine cover to cover. You should also know that there must be plenty of others out there who apparently do the same. Within the last two weeks I have received not one but two responses with the correct information from fellow ham readers. Although I know I would have done the same, I somehow thought that no one else would pay any attention to the "small problem" I had with a little speaker unit. It really made my day and got me thinking that the world is not that bad yet, as long as there are decent people like you and the rest of us hams who would walk the extra mile to help another human being.

Thanks again for helping your readers, and keep up the excellent work you do with your magazine. ☐

RF Effects Docket Issued

The FCC has released a Notice of Proposed Rule Making to update guidelines and methods used for evaluating the environmental effects of radio frequency radiation. The commission is using the 1992 RF exposure standards adopted by the American National Standards Institute and the Institute of Electronic and Electrical Engineers.

In 1985 the FCC adopted 1982 ANSI guidelines, which resulted in some transmitting facilities being required to prepare an Environmental Assessment if they would expose humans to RF levels greater than those recommended by the guidelines. Under the 1985 guidelines, many low power, intermittent, or normally inaccessible RF facilities were not affected by these FCC rules, including amateur radio stations.

The 1992 ANSI guidelines are more restrictive of RF radiation, and they also extend the frequency range under consideration from 3 kHz to 300 GHz. The new guidelines also specify two sets of exposure recommendations: one for "controlled environments" (usually involving workers), and one for "uncontrolled environments" (usually involving the general public).

Hand-held devices are treated for the first time in the new ANSI guidelines. The 1982 guidelines excluded devices that did not exceed a "specific absorption rate" (SAR) or whose input was 7 watts or less. The 1992 guidelines also contain low power exclusions, but they are more stringent and could require manufacturers to demonstrate compliance with SAR requirements.

The comment date in this docket, ET 93-62, is August 13, 1993. The reply comment date is September 13, 1993. *TNX Westlink Report, Number 648, April 29, 1993.*

HF Digital Mode R.M. Released

The FCC has issued a Public Notice on the ARRL proposal for digital rules for the amateur high frequency bands. The proceeding, which bears the file number RM-8218, originated with submission of the request by the League on February 1, 1993. Copies of the 36-page paper may be obtained from the Regulatory Information Branch at ARRL headquarters. Enclosing a large self-addressed envelope bearing six units of first class postage will speed the reply. *TNX ARRL, Westlink Report, Number 648, April 29, 1993.*

Midland is Back

Midland has returned to the amateur marketplace! The company generally credited with bringing the 1-1/4 meter band to life in the mid-1970s with its relatively inexpensive model 13-509 transceiver now has its own 2 meter hand-held and a full line of mobile antennas. The 73-005 is a relatively inexpensive, yet full-feature, 2 meter talkie that weighs only 6.5 ounces, receives 128 to 174 MHz, and has up to 5 watts output using an optional battery pack (2 watts with the standard pack), 0.16 μ V sensitivity and 200 milliwatts of receiver audio, all packed into a 5-1/2" x 2-1/8" x 1-5/16" case and priced at

\$288. For mobile operation, Midland now has a full line of magnetic-mount, NMO mount and glass-mount 2 meter and dual-band antennas ranging in price between \$28 and \$40. For more information on this new radio and the antennas, visit a factory-authorized Midland dealer.

Form 610 Change

The FCC says that hams no longer need to enter their transmitter location when filling out a Form 610 Amateur License Application Form. This information has heretofore been required on line 8. This would also seem to imply that section 2H (Change in Station Location) is no longer necessary. This change in filing requirements appears to be a cost-cutting move to reduce the labor involved in data entry for amateur radio Part 97 licenses. *TNX W6NLG, Westlink Report, Number 646, March 31, 1993.*

Novice/Tech 30 Meter Petition Denied

The FCC has denied a petition to grant Novice and Morse-code-certified Technician Class licensees access to the amateur 30 meter band. The petition, by William G. Welsh W6DDB, asked that such licensees be allowed CW operation from 10.1 to 10.15 MHz. Welsh argued that the 40, 15 and 10 meter bands currently occupied by Novices and Technicians are becoming less useful due to changing sunspot conditions and interference from shortwave broadcast stations. He also said that the longer antennas needed for operation on 80 meters limited the appeal of that band for Novices and Technicians.

The FCC said that in opening the 30 meter band to the Amateur Service in 1985 it had not included Novices and Technicians in order to promote an acceptable balance between licensing incentives and operating privileges. It followed the same guideline in the opening of the 17 meter band in 1989, the FCC said.

Thus, this petition for rule making was repetitive, the FCC said. *TNX ARRL; FCC; Westlink Report, Number 649, May 13, 1993.*

Sale of Airwaves Gains Support

A Clinton Administration plan to sell much of the electromagnetic spectrum to the highest bidder as a way of increasing government revenues has gained conditional support from industry and regulatory officials. While some government regulators did caution that any bidding process must provide the smaller business with the ability to compete for this resource, they were generally in agreement that such a sale could help offset the rising federal debt.

Congress is currently considering legislation that would transfer some 200 MHz of government-used spectra to the private sector for the development of emerging technologies like advanced cordless telephones, radio LANs, worldwide paging systems, personal locators and other such devices. The House has already passed its version, while the Senate still has its measure under consideration. Both

versions contain wording that would permit the allocation of some of the frequency bands by auction.

While industry leaders see the transfer of this spectra as a boon to the United States economy, several groups, including the National Association of Broadcasters and the American Radio Relay League, feel that the services they represent should be excluded from any competitive bidding of reallocated spectra because of the services they provide. The ARRL is working toward inclusion of language in the final bill to either protect amateur radio from any reallocation or to provide alternative spectra if any reallocation of ham bands shared with the government takes place. The NAB feels that the television broadcast bands should be excluded because the FCC is aware that applications for these frequencies must be based only on their fitness to serve their local communities. *TNX Westlink Report, Number 646, March 31, 1993.*

Jury Finds 60 Hz EMF Not Cancer Cause

In a case that has caused considerable interest among radio amateurs nationwide, a jury ruled on April 30th that high voltage power lines which transversed the home of a couple with a nine-month-old daughter did not cause the child's rare kidney tumors.

The debate over the danger of high intensity 60 Hz electromagnetic fields has been going on for well over two decades, with several carcinoma experts suggesting that prolonged exposure to these elevated EMF fields could be the source or trigger for several different medical problems, especially in children and pregnant women.

Fear of these fields has caused warnings to go out for women carrying children to avoid working near high current machinery or even using electric blankets during their earliest months of pregnancy.

Although more than 100 studies have been conducted in the past 20 years on EMF effects on human tissue, no conclusive evidence for a direct link between the high power fields and cancer has been proven, though several of the studies suggest an elevated incidence of certain tumors.

The jury took only four hours to reach its verdict, and although this is believed to be the first case of its kind involving an action against a public power utility, legal observers believe that it won't be the last. *TNX W6RCL; Associated Press; Westlink Report, Number 649, May 13, 1993.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at 73 Magazine, Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one stop bit. News items that don't make it into 73 are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327. **73**

Type "N" RF Connectors

How to install and use them.

by Steve Katz WB2WIK/6

In my article in the May 1993 issue of 73 ("The Hows and Whys of Coaxial Cable," pp. 10-19), I hinted that future articles would supply information on the proper assembly and use of RF connectors. The June issue contains an article on the proper assembly of "UHF" type PL-259 RF connectors for use on the popular coaxial cables. Because the UHF connector assembly is rather complex, its discussion consumed an entire article. Now we can address the installation and application of the *best* RF fitting commonly available for amateur use: the Type N.

Type N connectors are available in a wide variety of designs, all of which should be suitable for use through at least 3,000 MHz (3 GHz), and some which are good right on up through 18 GHz! They are far superior to UHF type PL-259 fittings in many respects, although you probably won't notice any improvement in performance unless you use them at or above 440 MHz (70cm). But even at lower frequencies type N connectors are popular and are often found on commercial and military equipment and antennas intended for use on frequencies as low as 1 MHz. This is because type N fittings cost little more than UHF types and meet military standards for moisture and fungus resistance, which UHF connectors do not.

Assembly

It makes good sense to learn how to assemble N connectors, especially the standard male type N UG-21. Don't be scared off by

stories you've heard about these rascals being difficult to install—nothing could be further from the truth.

It is true that military grade type N connectors, (at least the solder type, as opposed to the crimp variety), contain more pieces than UHF's. The number of pieces used vary with connector design and manufacturer, but let's concentrate on the most popular type N for amateur use, the UG-21D/U, which has six pieces: (Photo A) the body, the center pin, the braid clamp, the rubber gasket, the rear washer, and the nut. This sounds more complicated than it is, since the *only* piece that requires soldering is the center pin, which solders very fast and easily. Other than this one piece, connector assembly is purely mechanical and requires only two open-end wrenches, a 5/8" for the rear nut and an 11/16" for the connector body.

In addition to the two wrenches you'll also need a few other standard tools for cable preparation: a sharp single-edged razor blade or X-Acto knife; a pair of small, sharp scissors, such as manicure scissors (I use the set contained in my Swiss Army knife, and this works well); and a light-duty soldering gun (75 to 100 watts is fine) with an appropriate tip. Some 60/40 or 63/37 alloy (tin/lead) radio solder with a rosin flux core will also be used. All these things are required for PL-259 UHF connector installation as well, but for a PL-259 you need a *much* larger soldering gun (like 260 watts) because you need to solder the coax braid to the connector body,

which is *not* required with a type N.

Assuming you are using RG8/U-sized cable (RG8/U; RG8A/U; RG213/U, etc., all of which are 0.405" nominal outside diameter), prepare the cable end as follows:

1. Slide the type N rear nut onto the cable before proceeding with any other operation. The nut threads should face the end of the cable where the new connector will be installed, and the 5/8" (across the "flats") wrench part should face away from the connector, toward the balance of the cable. Slide this down the cable at least several inches to get it out of the way of your work.

2. Next, slide the flat washer (5/8" o.d., and about 7/16" i.d.) onto the cable, over the jacket, so that it will be located between the rear nut and the connector body. The washer has no "polarity."

3. Now, slide the rubber gasket onto the cable, also over the jacket, so that the *grooved* side of the gasket faces the cable end, and the flat, smooth side is towards the washer you just installed in step 2.

4. How long did this all take? Probably about five seconds. Push the three parts already on the cable far enough out of the way so they won't interfere with the rest of your work—you won't be needing them until the very last step when you tighten the connector together.

5. Now you are ready to strip the cable (Photo B). Use the razor blade or X-Acto knife to cut into the cable, applying enough pressure to cut through the outer jacket, braid



Photo A. Here are the six pieces that make up a standard UG21D/U type N connector (left to right): the body, the center pin (note the gold plating), the braid clamp, the rubber gasket, the washer, and the nut.

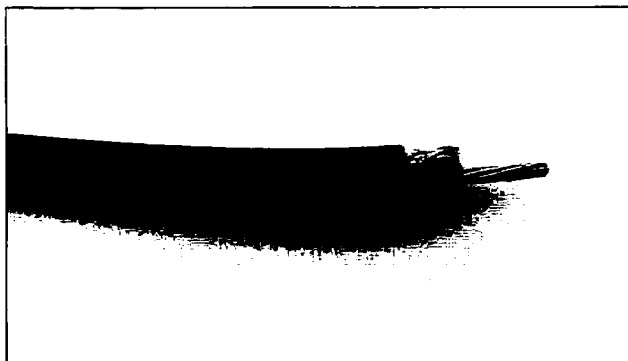


Photo B. The end of a piece of RG213U, all stripped and ready for pin and connector installation. (Not shown are the rear nut, flat washer and rubber gasket installed in steps 1, 2, and 3.) Note that the center conductor strands are tightly twisted and no braid "hairs" extend beyond the dielectric.

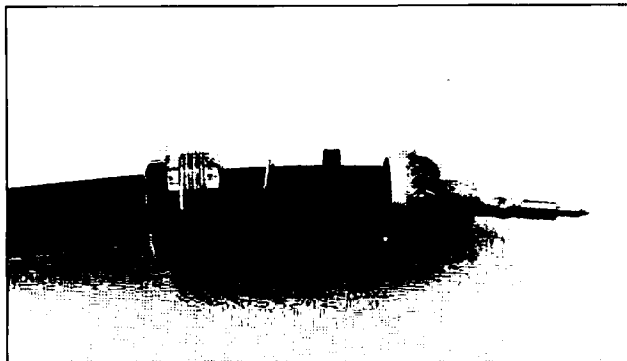


Photo C. Here, the center pin has been neatly soldered on so that solder completely fills the solder hole in the pin. The braid is pulled back over the dull edge of the braid clamp and the gasket, washer and nut are ready to assemble into the connector body.

and dielectric insulation material all at once. Stop when you "hit" the center conductor. Make this cut exactly 5/16" back from the cable end. It is easy to tell, with a bit of practice, how much pressure to apply to cut cleanly through all the layers *without* nicking or damaging the center conductor. The outer jacket will produce almost no resistance to cutting; the braid will produce considerable resistance, but a few "saws" with the knife and you'll be through it. Then the dielectric will produce some moderate resistance, but not a lot. When you cut through these layers and reach the center conductor, it is obviously much harder than the dielectric, and as soon as you feel its resistance, *stop*. If you find that you've nicked the copper center conductor even a little bit, cut off the damaged end of the cable and try again. It won't take long before you're an expert at this.

Once you've cut through to the center conductor (but stopped short of nicking it), hold the blade against the cable with the same steady pressure and rotate the cable 360 degrees to cut all the way around it. When you're done, you should be able to give a gentle pull on the end of the cable to completely remove the stripped section and reveal 5/16" of nice, shiny, undamaged center conductor. With practice, this operation takes about 15 seconds.

6. (For steps 6 through 10, please refer to Photo C.) Now, use the razor blade or X-Ac-to knife to make a cut in the cable's outer jacket *only*, 3/16" down from the end you cut off in step 5. The outer jacket will cut easily—don't apply enough pressure to cut into the braid. If you damage the braid you'll have to start all over, so be careful. Apply very gentle pressure and rotate the cable 360 degrees until you've made a shallow cut all the way around. When you feel the slightest resistance from the copper braid *stop*—you've cut far enough. Pull off the 3/16" of jacket material, exposing this much undamaged braid.

7. Push the open end of the type N center pin onto the cable's center conductor. If you're using stranded-conductor cable (and I

hope you are—it's much more flexible and easier to work with in the long run), be sure that no strands are separated from the bundle before attempting to push the center pin over it. If any strands are separated, gently twist them back together, making sure to twist *in the same direction* as the conductors were originally stranded by the manufacturer. The center pin should "bottom out" on the tip of the center conductor, with the open end of the center pin laying flat against the cable's dielectric. If this is *not* the case, and the pin "bottoms out" with more center conductor still showing between the pin and the dielectric, you need to cut a bit more off the center conductor length. Look to see how much center conductor shows between the end of the pin and the dielectric; pull the pin back off, and cut off that amount of center conductor. Now, push the pin back on. It should bottom out on the center conductor and rest against the dielectric with no extra center conductor showing. Again, this step could take a bit of practice, but after you've installed a few connectors it will take only a few seconds.

8. Lay the end of the cable, with the pin installed, on a flat working surface and place a gentle weight (like a heavy book) on the cable about 4'-6" back from the end of the cable. Twist the center pin until the soldering hole shows on *top*, so you can get at it easily. Apply heat from your soldering iron or gun to the pin, near the hole, and wait a few seconds for the heat to transfer. Applying a *small* amount of solder between the pin and the tip of the iron will make this heat transfer go much faster.

When the pin has reached soldering heat (this shouldn't take more than five or six seconds), apply solder directly to the hole in the pin. After it flows, continue to push a bit of solder into the hole to be sure it "wets" to the cable's center conductor. Don't use too much solder or it will be difficult to get the excess off the outside of the pin (and this will be necessary to complete connector installation and use). Take the iron and solder away, and wait about 10 seconds for the pin to cool off.

Blowing gently on the pin will accelerate this process. When the pin has cooled down so that it's not too hot to touch, pull on it gently to be sure it is well attached to the center conductor. If it pulls off, the solder didn't "take," indicating either not enough soldering heat, not enough solder, or an oxidized center conductor. If the center conductor looks bright and shiny, it's not oxidized. If it has a dull or oxidized appearance, there's something wrong with this piece of cable and it probably shouldn't be used anyway. Try again, and with practice you'll find the pin and conductor will "wet" very well and the pin will be impossible to pull off with your hands.

9. Assuming the pin is properly soldered, inspect the outside of the pin to see if excess solder has flowed onto it. Excess is any amount that causes a "bump" in the diameter

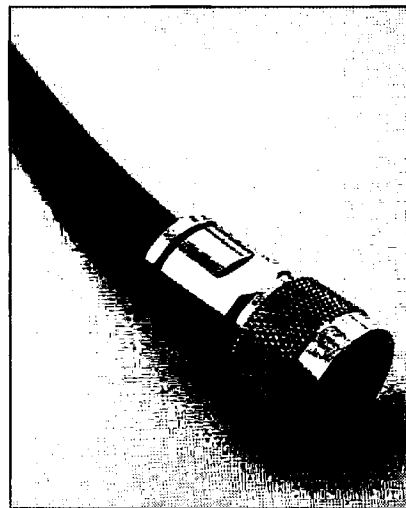


Photo D. The completed, installed type N connector. When the rear nut was tightened a very small space remained between the nut and the connector body. This is perfectly normal. Using high-quality, open-end wrenches for final assembly avoids scratching or nicking the connector plating and leaves a shiny, weatherproof surface.

of the pin. A thousandth of an inch of solder is not a problem, but ten thousandths probably is. If excess solder is on the pin, use a very fine grit emery cloth or very fine nail file (not a large machinist's file or rasp!) to gently file it away. You don't want to file away at the center pin's original plating, which is likely to be a very fine layer of gold. Again, with practice there won't be any excess solder anyway.

10. Slide the braid clamp over the end of the cable, with the smaller-diameter end towards the connector pin already installed, and the larger-diameter end, which should be beveled and have a rather sharp edge, towards the bulk of the cable, rubber gasket, washer and rear nut already installed in steps 1 through 3. Gently fold the braid back over the metal braid clamp until all of it is folded neatly against the 3/16" shaft of the clamp. If you trimmed the jacket correctly in step 6, the braid will *end* before the beveled part of the braid clamp. If you cut off too much jacket, braid "hairs" will extend over the beveled portion of the clamp, and this is no good. Some hams just "trim away" any extra braid at this point, but this defeats the purpose of using a type N connector: If the braid is too long, that means too much jacket has been removed, which also means too much dielectric will now be exposed between the clamp and the pin. This will ruin the geometry of the installation, make "seating" the connector

difficult, and defeat the purpose of using such excellent "constant impedance" connectors. If you made a mistake, it's better to chalk it up to experience and start over with step 5.

11. You are now done with all the critical operations. All that is left is to screw the connector together. Push the connector body over the pin and onto the cable, with the threads "first," towards the bulk of the cable. If no excess solder is present on the pin this should happen quite easily. You might meet with just a little resistance as the pin inserts itself into the Teflon dielectric of the connector body, but a bit of a "push," and it will be on. This will place the braid clamp fully inside the connector body as well, as you will see. When you've pushed the body onto the cable, and all steps have been done properly, the tip of the center pin should be about "flush" with the end of the connector, and the rear end of the braid clamp will be fully inserted inside the body, now recessed about 3/16". If this *doesn't* happen, you didn't follow some instruction. Think it out, and try again.

12. Slide the rubber gasket down to the connector end of the cable until it seats itself on the rear (beveled, sharp) end of the braid clamp. These two pieces are designed to "mate," and the beveled end of the braid clamp will end up inside the rubber gasket. If you're thinking that the braid clamp will cut

the rubber gasket in half when the connector is fully tightened on, you're correct: This is part of the design.

13. Now, slide the flat washer down to the rubber gasket so that it rests against the flat side of the gasket and is fully inside the connector body.

14. Slide the rear nut down to the connector body until it mates with the body's threads, and gently twist the nut clockwise to screw it into the connector body. After four or five twists you should begin to feel some resistance to further threading. Now is the time to get out those two open-end wrenches! Use the 5/8" wrench on the rear nut, and a *thin* 11/16" wrench on the "flats" of the connector body (a "fat" or "thick" wrench usually won't fit—there is only about 3/16" space here for the end of the wrench). Hold the body firmly while threading the nut into it until you meet considerable resistance to further threading. At this point, the rear nut should either be "bottomed out" right against the connector body, or close to it, with a *very small* space showing between the nut and the body. You're done! (See Photo D)

Although this took a lot of description, complete installation of the UG21D/U type N male connector takes only about two to three minutes for the beginner, and far less time for an experienced technician. When I worked in an engineering lab many years ago I'd take an entire day about once or twice a year just

The ears have it!



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*Bill Clarke
73 Amateur Radio Today*

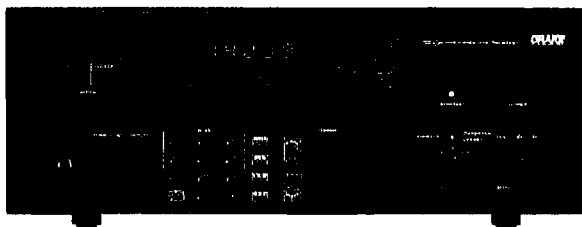
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to build type N "patch" cables for the lab, and could usually assemble 50 or 75 such cables per day, with two connectors per cable. This is a lot of connectors, considering I'd take lots of breaks to avoid total boredom.

To test your completed connector assembly and installation, hold the connector firmly in one hand, grab the cable about six inches away in the other hand, and give the cable a firm pull. You should *not* be able to pull the connector off the cable. In fact, even 50 pounds of tension will not pull off a properly installed type N because the braid clamp has amazing strength. You might also want to use an ohmmeter to check for the possibility of a short circuit between the pin and body of the connector, but if you've followed directions, this is *extremely* unlikely.

Caveats

If you use *foam* dielectric cable (any brand) or Belden 9913 type cable, do *not* expect the standard UG21D/U center pin to fit the center conductor! Foam cables and 9913 both use "oversized" center conductors (due to the lower dielectric constant of the insulation material used) which is larger in diameter than standard RG8A/U or RG213/U military types, and will not fit the standard pin dimension. Thankfully, special type N connectors *are* available for these non-standard cables. They are often sold as UG21-9913 or some such nomenclature to indicate they are

supplied with an oversized pin specifically to accommodate the special cables.

If you use double-shielded cable like RG9/U or RG214/U, the braid may *not* fit in a standard UG21/U braid clamp/body assembly. These specialty cables also have special connectors made just to suit them. (Frankly, unless you are using the cables to interconnect repeater duplexer cavities, I can't imagine why you'd want to use double-shielded cable. It is not any better in any respect than single-shielded cable, with the sole exception of its reduced RF leakage property. Single-shielded cable like RG213/U has low enough leakage for 99.9% of amateur applications.)

There are varieties of type N connectors which are more complex and contain more pieces than the UG21D/U type described here. For the most part, they aren't any better, except possibly at the high end of the SHF spectrum (above 6 GHz) and therefore might best be avoided. Conversely, there are some excellent type N "crimp on" connectors which require no soldering at all and are thus even easier to install than the one described here. The problem is, some of these cost far more and require specialized and expensive tools for their installation. A good, standard type N UG21D/U connector that will install exactly as described here and is of high enough quality for the vast majority of amateur applications is the Amphenol "RFX" series, part number 82-202-RFX. This six piece

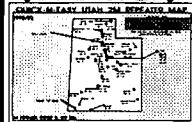
connector, as I've described, is bright nickel-plated for excellent resistance to weathering, and is relatively inexpensive, averaging around twice the price of a cheap UHF type PL-259.

One more note: Yes, type N connectors are available for practically every type of coaxial cable, from subminiature RG174/U to "water-hose" sized RG17A/U. The connectors intended for use with smaller cables (RG174/U, RG58/U, RG59/U, RG8X, etc.) have a smaller rear nut, washer, gasket and braid clamp and a smaller hole in the center pin, but otherwise install as described. The connectors intended for use with larger cables (RG17/U, RG217/U, RG18/U, etc.) have a larger body and rear nut, washer, gasket and braid clamp, and a larger hole in the center pin, but still install as described. If you practice with a piece of military standard RG213/U you'll learn enough to know how to install *any* of the type N varieties on any cable type.

Once you get the hang of it, installing a type N fitting is as easy as falling off a log and much less painful. The type N has lower loss than a UHF type PL-259, especially in the upper VHF and UHF spectrum (300 MHz and above), is more weather-resistant, handles more RF voltage, and will fit more high-end commercial and military equipment and antennas. If you *don't* get familiar with using them, you're missing the boat.

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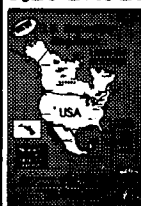


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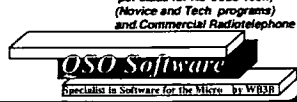
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Mobile CW Operation

Ham radio's oldest mode keeps rolling.

by Steve Katz WB2WIK/M6

Wait a minute, what's that again? Who would want to operate mobile CW?

I do, for one, and I'm finding a growing number of mobile CW enthusiasts on the HF bands who must agree with me that it's great fun and more productive than mobile phone (SSB) operating. CW is our oldest mode of amateur radio communications, and enjoys an 80-plus-year history of hundreds of thousands of operators and many millions of successful contacts made. Yes, it's old-fashioned, but CW is hard to beat for making contacts with minimal equipment and antennas. Because of its narrow bandwidth and smallest-possible consumed spectrum, CW is an efficient mode of communications. The "newer" digital modes, like RTTY, AMTOR and packet are a bit faster and more automated, but all require specialized equipment that cannot always be managed for field, portable or mobile operations.

Mobile operations, besides being fun and a great way to pass the time while stuck in traffic, lends itself beautifully to CW work. How does one drive a vehicle and send CW at the same time? Easily! How do you drive and talk into a microphone at the same time? It's almost the same thing, and while most

mobile phone operators have had at least one experience where the mike cord got entangled in the steering wheel or knocked over a cup of coffee sitting on the dashboard, a properly laid-out mobile CW station will never encounter these difficulties! How does one concentrate on driving and copy CW at the same time? Easily! Of course, you must copy "in your head," and not be reliant on pencil and paper, lest your mobile CW operations become deadly hazardous.

Based on my several years' experience in operating mobile CW, I have developed a few ground rules by which newcomers to the art must reasonably try to abide:

1. It helps to be a good CW operator to start with. Sloppy sending or poor copying ability will make mobile CW work nearly impossible. Practice at home for as long as it takes to become proficient in CW work, and wait until you start receiving unsolicited compliments on your "fist" before attempting mobile CW work.

2. It helps to have small, uncomplicated equipment. While a new TS-450S might make a good mobile rig, it has too many knobs and buttons, which might be a distraction. I'd stick with simple, inexpensive, sol-

id-state (and no-tune) rigs. My latest acquisition for mobile CW work is the new MFJ model MFJ-9020, a 20 meter (only) CW (only) transceiver which occupies less space than the average 2 meter FM rig, weighs almost nothing, mounts anywhere, and has a list price of only \$179 (I got mine for \$169, brand-new). See Photo A. This little rig works incredibly well and has only four front-panel controls, one of which is the ON/OFF switch! Who needs S-meters, output level meters, dual VFO's, memories and so forth while they're driving 60 mph on the freeway? Surely not I.

3. Permanently mount your keyer paddle in the most convenient and comfortable place possible. I have mine, an MFJ 442B-X (electronic keyer and Benchner paddle in one small box), attached to my center console between the two front seats of my car, between the gearshift handle and the parking brake handle—a nearly perfect spot, at a reasonable height to make sending very comfortable. See Photo B. Route all wires and cables so they're not in the way at all, and are preferably hidden from view altogether. (I have mine "tucked away" under various parts of the console cover materials.)



Photo A. The little MFJ QRP-CW rig will mount just about anywhere, and is so light that a plastic dash will hold it just fine. I used an old bracket from a Radio Shack CB rig (or something), modified slightly for the MFJ rig.



Photo B. The MFJ/Benchner keyer/paddle combination works well and is mounted with Velcro™ to the center console between the front seats of my car. Convenient, handy, unobtrusive and just the right height for easy keying while mobile!

4. Use an external speaker for the receiver, preferably one that can face directly at you. I use an amplified speaker to help overcome road noise: a great deal from Radio Shack, model 21-541. This speaker, which requires a source of 12 VDC power as well as audio drive, produces 8 watts of undistorted audio, sounds great, and costs about \$25.

5. Since mobile stations must use compromise antennas due to space limitations, use the best mobile antenna you can find (whether it be purchased or home-brewed). I use a Hustler™ fold-over mast with screw-on resonator/whip assemblies, mounted on a heavy-duty "ball" (3/8"-24 thread) on the rear fender of my station wagon, with the ball height 32" above the road surface. The antenna, with the 20 meter resonator/whip installed, is 86" long and 62" of its length is completely above the roof line of the vehicle. It works so well that I often can't believe it! I've worked about 45 states and 70 countries with this system so far (in the past few months). There are many mobile HF antennas on the market, and most of them will work well if properly installed.

6. If you like DX, stick with the higher HF bands (20 through 10 meters). Conditions are better and the antennas are more efficient, and cover greater bandwidth, than ones for 30-40-80 meters. (Although 30 meters, being a digital-mode-only band with enforced power restrictions, might be kind of fun from the car—I haven't tried it yet.) Twenty meters is probably "open" more hours per day, and more days per year, than any other band, but 17 and 15 meters aren't too far behind, and 12-10 meters can be great daytime bands in the winter months. Over the last two winters (1990 and 1991), using a Radio Shack HTX-100 10 meter 25W rig and an 8' long "CB" whip (cost: \$9.95), I worked mobile CW DXCC.

7. If you *really* like DX, try a mobile power amplifier! I use a home-brewed one (shown in the photograph) which cost about \$60 to build and uses a pair of MRF247's to develop 100W output power with less than 5W drive across the HF spectrum, 3-30 MHz. This amp was a cinch to build and is essentially identical to the Communications Concepts, Inc. (Beavercreek, Ohio) model EB-63, which sells for \$89.95 in kit form, without cabinet or heat sink. My little amp sits tucked away in the corner of the trunk, just a few inches from the antenna base. (See Photo C.)

8. Answer CQs on an active band; only call CQ when the band's nearly dead. No matter what you run, your mobile signal will not compete very well with base-stations using higher power and efficient antennas. (However, I have been able to work weak DX stations right through enormous pile-ups when I've been parked at advantageous locations. Using 100W and my mobile whip, while parked on a good mountaintop with a clear horizon in all directions, has done better for me sometimes than my legal-limit station at home. Driving or parking along an



Photo C. The trunk compartment with the hatch door removed. The 12 VDC cooling fan is mounted to the hatch cover and blows directly on the mobile amp's heat sink, which is normally just a few inches below the fan when the hatch is closed. The amp can be seen to the right.

ocean beach isn't bad, either.)

9. Be sure to make your own vehicle as free of ignition noise in the RF spectrum as possible. You can't control other vehicles on the road, but almost any motor vehicle can be improved in this area. Simply using resistor-type spark plugs and shielded ignition wiring, regularly replaced when worn, goes a long way towards minimizing ignition noise. My Volvo wagon, factory-equipped, happens to be a very low-noise vehicle, but many aren't.

10. Lastly, when using long or top-heavy mobile antennas (as many are) it often pays to "guy" them a bit to prevent damage from high-speed driving. My Hustler 20 meter whip would place too much strain on any conventional ball mount when traveling at high speeds (let's not discuss *how* high) if it weren't secured with a piece of string to the roof rack of my car.

So much for suggestions. How are mobile CW contacts made? No sweat! Same as home-station CW contacts. You either answer someone else's CQ, call CQ yourself, or break into a CW QSO if it sounds interesting. Your mobile rig will *have* to have some sort of break-in capability (full QSK or "semi-QSK," which is usually the same as VOX on SSB) so you only need to touch the paddle to send. After just a bit of practice you'll be having long CW rag-chews with the best of us. Operating mobile phone or CW is all the same—if you can't chew gum and walk at the same time, mobile operation on any mode is not for you. But if you've had no problem with VHF-FM mobile work, then CW HF mobile work is not any more difficult, provided you're a proficient CW operator to begin with.

Personally, I *like* CW. It's very relaxing to me, and easier to listen to for long periods than phone. Probably the great narrow-band-

width CW filters that allow only one signal to pass to the speaker have a lot to do with this. You can't use a 500 Hz filter on SSB, but on CW it's the norm. Even my little MFJ-9020 has a factory-standard narrow CW filter (with an even narrower one available as an option) which, for the most part, is narrow enough to allow receipt of just one signal at a time, even during crowded conditions. While headphones make CW operation even easier at home, I'd not recommend them for mobile work: They're illegal to use while driving in most states, and might restrict your ability to hear emergency sirens or horns honking. As with any mobile work, the task of controlling your vehicle must take priority over a QSO. Occasionally you might need to forget about your QSO and make an emergency maneuver—just do it, and forget about the QSO. Your contact will probably still be there after the emergency is over, but if not, so what? There will always be another contact.

I guess in addition to being a proficient CW operator, it pays to be a good driver! I'd not recommend mobile CW work (or maybe mobile work of any kind) for brand-new drivers who are still learning the ropes, or for nervous drivers who consider the task of keeping their car on the road an enormous job that requires 100% concentration and then some. But for those of us who drive comfortably in all kinds of conditions, and those who, like me, log 50,000 miles per year on the roads with zero accidents, mobile CW operation should be as easy as falling off a log. And speaking of logs, don't forget to keep one in your glove compartment to record all the great DX you're going to work!

Hope to hear you on the CW bands. For now, this is WB2WIK/M6 (mobile, 6th call area) QRZ DX?

by David R. Corsiglia WA6TWF

The AEA HamLink

Model HL-60

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Does your radio miss you when you're not home?

Did you work late and miss your sched, again? Did you miss that rare DX contact that waited for you to get to work before transmitting? Do you want to let your friends try out your rig without the hassle of throwing a party? Well, now there's a solution for these problems and more: HamLink—the interface between your telephone and ham radio. It allows remote operation of your HF, VHF, or UHF transceiver. Any time you're near a Touch-Tone phone you can control your radio almost as if you were home.

The TWF Super System, a 15-repeater (440 and 1.2) membership group, recently installed a HamLink. We are certainly enjoying giving it a workout! Our members were already comfortable with the idea, because they regularly use our three remote base repeaters by operating HF radios remotely using the DTMF tones on their 440 transceivers. But now, with HamLink installed, they're able to work HF even from work or from friends' and relatives' homes. For the first time, remote CW! With a speaker phone, it's easy to share the fun.

Club members and elmers can make HF stations available to other hams this way. We found the unit's voice announcement of frequency and mode worked great for sight-impaired members.

The HamLink can be interfaced with receivers and transceivers which are computer controllable (although no computer is required). The interface cable between HamLink and the radio is specific to the radio's manufacturer and can either be purchased or home-brewed from the wiring diagrams and parts lists in the manual. We installed our unit on a Kenwood TS-940S.

Installation was simple and the instructions were clear and easy to follow. The four cables that make up the interface are for the computer port and external speaker (all compatible radios) and the jacks for the CW key and microphone (transceivers only). The other connections are for power (either AC or 12 VDC) and, after initialization, the telephone line. Initialization consists of introducing your radio to HamLink, entering the security code, and setting the telephone answer mode.

The telephone can be answered after a spe-



Photo A. The AEA HamLink Model HL-60.

cific number of rings or, if HamLink shares the phone line with an answering machine or fax, it can be set to answer immediately after a hang-up and call-back. The telephone answer mode can be changed remotely as well.

We can call HamLink with any Touch-Tone phone. After entering the security code, there we are—listening to the band according to the frequency and mode we were last on. We can easily change to whatever frequency our radio is capable of receiving.

This means that, depending on the radio, you could listen to any frequency: the AM broadcast band, WWV, shortwave broadcast band, 2 meter FM, 20 meter upper sideband, etc. The radio can be tuned to a specific frequency or pulsed up or down in 10 Hz, 100 Hz, 1 kHz, or 5 kHz increments. With a little practice you will easily be able to tune in all the modes, including sideband signals.

When you have tuned in a station and you are ready to transmit, depress the "★" Touch-Tone button; then on you will be transmitting. When you are done transmitting, depress the "★" button again to put the radio back into receive.

You may also select either of the two VFOs or the radio's memory mode. Then you can select different memories or scan the memories. You can request the frequency the radio is on at any time and the interface will reply with a "human voice" telling you the exact information. You may also inquire about the mode, such as USB, LSB, AM, narrow FM, wide FM, CW, and RTTY, (although HamLink is not recommended

for RTTY use.)

You can even send CW through the HamLink via a Touch-Tone button on your phone. You may not achieve great speed, but it might just be good enough to grab that rare country that you have been seeking that only comes around while you are at work.

The AEA HamLink is very small (8" x 5" x 2") and only weighs three pounds. The unit is not polarity sensitive, so if you accidentally hook the power up incorrectly you will not smell smoke! The unit draws only 200 mA. So, with a 12 volt DC powered transceiver, it could be used for emergency communication in an earthquake or flood.

You can also plug a cordless phone base into the RJ11 jack inside HamLink, then just carry your cordless handset around your home to operate your transceiver.

A sightless and otherwise handicapped operator may find it especially advantageous to use a cordless phone as a control unit.

Hardware Requirements

In some cases you may need an additional computer interface board. These accessories can be ordered from the manufacturer. As of this date, the following radios and computer interfaces will work with the ARE-60:

- All ICOMs that have a CI-V computer port.
- The ICOM 751A has a CI-IV port and requires a UX-14 adapter to convert it to the required CI-V buss.
- Yaesu FT-890, FT-990, FT-1000, FT-747GX, and FT-757GX2. The Yaesu do not require an

additional computer interface.

Any Kenwood radio with an active computer port will work, but some radios need interfaces: The Kenwood TS-440 and R-5000 require an IC-10; the TS-711 and TS-811 require an IF-10A; the TS-940S requires an IF-10B; the TS-140 and TS-680 require an IF-10C; the TS-690, TS-450, TS-850 and TS-950 don't require an interface; the TS-50 requires an IF-10D.

Please note: More radios are being added to this list.

These computer interface boards are usually installed inside the radio. Not all dealers have the boards in stock so it is a good idea to get them on order at the same time that you order HamLink.

One of the best things about the ARE-60 is the ease of installation and setup. It took exactly 17 minutes from the time I opened the box to my first on-the-air contact.

I highly recommend that you order the optional cable kit for the radio you are going to use. It's inexpensive and very well-made. You merely plug in the cables from HamLink to the radio and from a Touch-Tone telephone to a RJ-11 connector inside HamLink.

You program HamLink with any standard Touch-Tone phone, inputting the type of radio you are using, as described in the very-well-thought-out operating manual. Then unplug the phone and connect a phone line to the RJ-11 phone jack on the rear of HamLink. You're ready to start having fun. That's all there is to it!

Our club gave HamLink a thorough workout. We set up a unit at our Orange County Super Station, where we have a full-size three-element 80 meter beam, six-element KLM tribander and a full-size 40 meter beam. To test for RFI we used an Alpha 87A running the legal limit. At a special club meeting we gave out copies of instructions for HamLink, along with the security code and phone number. For the next couple of weeks there were many phone

calls by members trying out the system and making contacts. The Touch-Tone codes are very straight-forward and there was very little problem in getting the members of the club up to speed.

They were able to use some of HamLink's auxiliary functions to switch antennas when needed. They found absolutely no RFI and everyone commented on the superb audio on both receive and transmit. In fact, the stations that were contacted via HamLink most of the time had no idea that we were operating remote via telephone.

All comments from members who tried HamLink were positive and most of them wanted to install a full-time dedicated station using it.

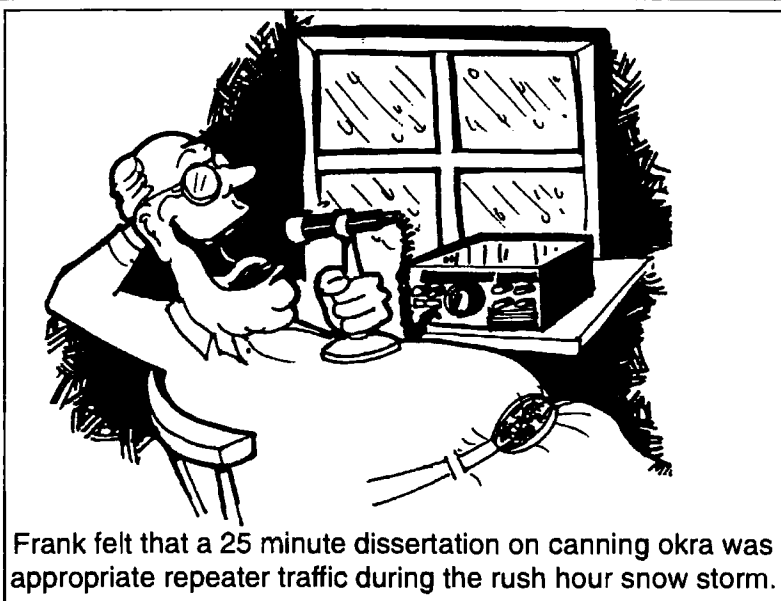
One of the neat things about HamLink is that you can listen to any frequency that the

transceiver is capable of. Many of the club members are also shortwave listeners and particularly liked tuning in a shortwave broadcast station, then using the 5KHZ step feature to step their way up and down through the short-wave broadcast band.

The only negative thing I could find with HamLink is that if you are not careful you could accidentally transmit out-of-band. You have to check the frequency announcement often as you are tuning around to make sure that you did not hit an out-of-band frequency by mistake.

HamLink does everything as advertised, and at \$269 it's a great bargain.

Contact David R. Corsiglia at 858 Lenz Drive, Anaheim CA 92805; telephone: (704) 535-5528; Fax: (714) 520-9087.



Frank felt that a 25 minute dissertation on canning okra was appropriate repeater traffic during the rush hour snow storm.

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CIRCLE 118 ON READER SERVICE CARD

73 Review

by Michael Bryce WB8VGE

The Hewlett Packard HP 34401A Digital Multimeter

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Add a top quality test instrument to your workbench.

I know several hams who will spend thousands of dollars on the newest rig this year but who don't own a useful digital multimeter. I don't have money to drop on new gear, but I do require a digital multimeter I can count on. I spend much more time at the workbench than at the operating table.

After going through a pile of off-brand digital multimeters, I decided that I needed something better than what the local Radio Shack carried. So, last year at the Dayton Hamvention, I started to look for a new bench-style digital multimeter.

My wife and I happened to stop in front of the Hewlett Packard booth. I took a quick look, told my wife that "HP" means "high price," and started walking away. Then an HP salesperson walked up to us and started talking.

What he showed me changed my mind about HP. The HP 34401A is a 6-1/2 digit, high performance digital multimeter in a bench-top style case. The HP 34401A does so many things that calling it a mere digital multimeter doesn't do it justice.

Features Abound

The HP 34401A has a highly visible vacuum-fluorescent display. It also has built-in math operations such as Min-Max, Null Value, High Limit, Low Limit, dB REL, etc., as well as continuity and diode test functions. The "hold" feature lets you make hands-free readings. How about an auto trigger set to take a specific reading at a certain time interval? The HP 34401A will even tell you how many times it's been calibrated!

You can set the resolution from 4-1/2 to 6-1/2 digits. You can turn off the autorange feature and use manual control. Two- or four-wire resistance checks make reading low resistance values easy. You can measure frequency up to 300 kHz as well.

Other features of the HP 34401A include an HP-IP (IEEE-488) interface and an RS-232 interface, both standard. You can program the HP 34401A with standard programming languages such as SCPI, HP 3478A and Fluke 8840. You may also use the HP 34401A in a remote interface setup. You can even set it up as a "go/no go" tester.

A front panel switch selects either the front test probes or the rear probes (a set of test probes comes with it). There are so many features that it's hard to keep track of them all.

Putting the HP 34401A to Use

Hewlett Packard includes two manuals with the HP 34401A. One is the user's guide and the other is a service manual. The manuals are super! They're easy to read, and you can find what you're looking for without digging through layers and layers of material.

Each HP 34401A comes from the factory with its own specifications and a certificate of calibration sheet. You know the amount of error on *each* range on almost every function. The DMM goes through about 100 separate tests before passing final calibration. You can have the HP 34401A calibrated to MIL-STD-45662A specs if you desire for an extra charge. You may also send the HP 34401A back to Hewlett Packard at any time to be re-calibrated for about \$90.



Photo A. The Hewlett Packard HP 34401A digital multimeter.

Each time you turn on the meter it does a quick self-test. You can do a more extensive test by holding down the "SHIFT" button when turning on the power. The HP 34401A will respond with a "PASS" on the digital readout.

Of course, the most common things we do with a digital multimeter is to measure voltage, current, and resistance. The HP 34401A excels in these areas. The HP 34401A measures voltage in the following ranges: 100mV, 1V, 10V, 100V, 1,000V (750 VAC). Maximum resolution is 10 nV on the 100 mV range. AC voltage is true RMS and AC-coupled. The HP 34401A will measure current from 10 mA to 3 amps.

Resistance ranges from 100 ohms to 100 megohms. Maximum resolution is 100 micro ohms on the 100 ohm range. The HP 34401A utilized either a two- or four-wire resistance measurement system. For normal resistance checks, the two-wire system works just like any other digital multimeter. But for low, low resistance checks, you'll get the best results with the four-wire method. By using the second set of test leads, you reduce the amount of resistance between the digital multimeter and the resistor you're trying to measure.

The HP 34401A uses a menu system to access sub-menus from the front panel. This is discussed in a very straightforward manner in the user's guide. There are plenty of diagrams to help you navigate the menus in the

user's guide. All you have to do is follow the prompts on the display to access the menu system. It's much easier to do than to explain, but the HP user's guide does an excellent job.

Operation is straightforward and very simple. Just select the function you desire and you're off and running. The autoranging is as fast as any I've seen. You don't have to wait for this meter to keep up with you.

There are several relays inside that you can hear switching on and off as the HP 34401A selects the proper range. After awhile I got used to the clicking and found that I could use the relays as an audio feedback when the meter would switch ranges. Let's say you're looking at the output of a voltage divider and it should be 7 volts. If you're busy flipping the switch on the rig you're testing, it's hard to keep an eye on the HP 34401A display. But, if you hear the HP 34401A flip a relay, you know your test point went over 10 volts. That's where the relays switch over.

I'm hell on digital multimeters. I always forget to switch from resistance before going to volts or current to frequency. The HP 34401A is very forgiving. I've only had to replace the current fuse twice and both times it's been because of operator error.

The Bottom Line

I love it! When the service manual says

the mixer should have 0.1785 volts on the emitter, the HP 34401A will let me know. No more guessing, no more wondering if the test meter is accurate, no more hassle with service personnel telling me my test meter is wrong.

I had some trouble with the local power company with low line voltage. I told the service person I had low line voltage. I was then asked how I knew the voltage was low. Was I using a department store meter? No! I'm using an HP 34401A by Hewlett Packard. Two hours later a repair truck arrived and found the problem.

Is there anything I don't like about the HP 34401A? Well, there is one little item—the marketing. Hewlett Packard says that the HP 34401A is their "low end" instrument. I don't like spending \$1,000 and then being told that I got a "low end" product. Their new "within budget, without compromise" is better.

I would have liked to have had a higher current rating: up to 10 amps instead of only 3 amps. You can add an external high current shunt for taking high current readings if you want.

Yes, it does cost a thousand dollars. But think about that for a second. Would you want to have someone fix your \$2,600 rig with a \$24 meter? This is a case where you really get what you pay for.

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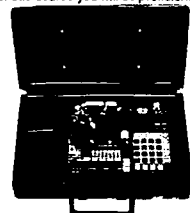


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CIRCLE 227 ON READER SERVICE CARD

A Tilt-Over/Swivel Antenna Mount for Recreation Vehicles

Take your full-size vertical on the road.

by Gene Beaver W4PVI

In the summer of 1982, Dot (MYL) and I decided that we were going to take a year's tour of the country in our 22' Mini-Motorhome. I most certainly was going to operate the HF bands, but I didn't want to be confined to a mobile antenna all that year.

Installation of an antenna on the roof was impractical due to the height involved because the antenna would not clear low hanging trees, bridges, etc. A quick-connect

would mean climbing the ladder each time it was used. Not very convenient!

I had a Hustler 5BTV Vertical on hand. To solve my problem I only had to figure out how to haul this tall antenna and how to make it quick and easy to put up and take down each time it was used.

I had been a member of the RV Service Net for a couple of years, and knew Chuck W8UCG (SK) (the originator of the Uni-Strut antenna mount on Airstream trailers). I decided to adapt the mount to my motor home.

Construction

After taking some measurements, I realized that if the Uni-Strut was used and the antenna base was to be about 12 inches above the roof, I would have to do an awful lot of climbing up and down the motor home's ladder in order to complete the installation and then do the required tuning. That didn't appeal to me at all. I had to find

a way to swivel the mount as well as fold it over.

The answer came out of the plumber's shop, where I obtained the following materials:

- 1 length of 1" galvanized water pipe
- 1 length of 1/2" water pipe
- 2 1/2" end caps
- 1 1/2" female coupler
- 1 1" female tee joint
- 1 1" floor flange
- 1 1" el (female one end, male the other)

I cut the 1" pipe into three lengths—one 97", one 18", and one 9"—and threaded on all ends. (The 97" length was required for installation on my present Allegro motor home and most likely will have to be changed for your rig.)

The floor flange was fitted to one end of the 97" length and the el to the other. Then I attached the center of the tee joint to the el. I tightened the last two joints snugly, then

Continued on page 31



Photo A. Close-up of the antenna mount.

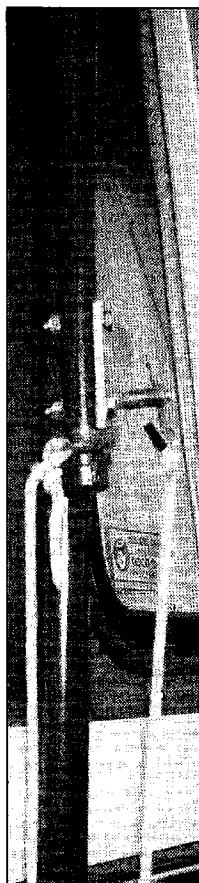


Photo B. Close-up of the tie-down rope attachment.

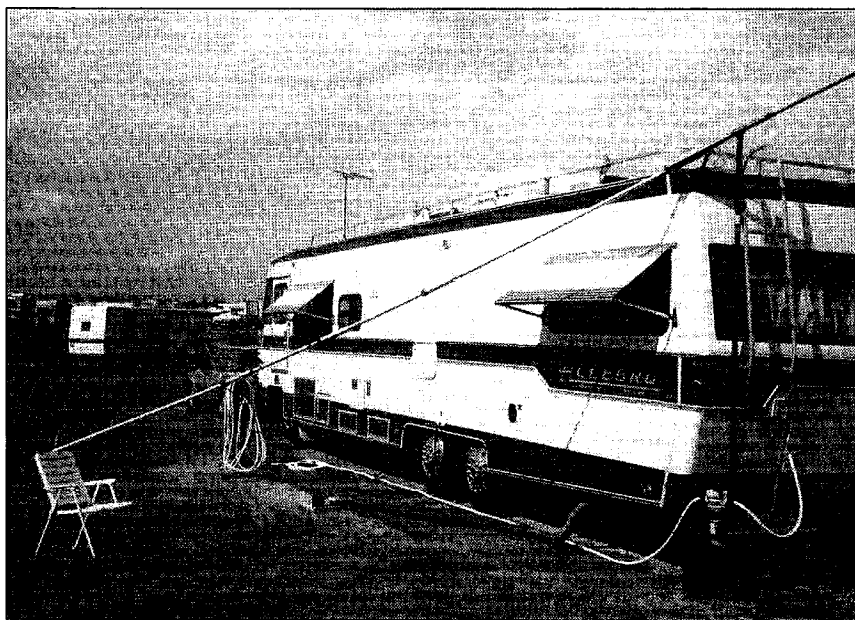


Photo C. Working on the antenna is easy—just swivel and tilt.

Tilt-Over Swivel Antenna

Continued from page 28

backed off half a turn. These are the points that allow the antenna to be raised and lowered and to be swiveled from side to side.

Next, I fastened the 18" length to the top of the tee and the 9" length to the other end.

The 63" length of 1/2" pipe (threaded at both ends) was passed up through the 18" length pipe, the tee joint and the 9" pipe. An end cap was installed on the top. The 1/2" coupler and a 3" length of 1/2" pipe were attached to the bottom.

Then I slid a heavy-duty key ring (yes, like a car key ring) over the bottom end of the 1/2" pipe, installed the other end cap, and attached a 6-foot length of 3/8" nylon cord to the key ring.

The entire assembly was set up vertically, with the floor flange resting on the rear bumper to which it was attached with counter-sunk screws.

The bumper now supports the weight of the mast and the antenna when attached.

Installation

The 97" pipe is attached to the roof ladder, approximately 60 inches up from the bumper. This provides the lateral stability. If it is not convenient to support the mast at the ladder, a suitable two-point brace can be used at a point on the RV where screws are already in place.

Once the mast is in place, and the antenna is in the "up" position, the 1/2" "handle" should be attached to the ladder or some other support.

You will be able to come up with your own method of securing the handle when the antenna is in the up position. This is necessary to assure that the antenna stays in the vertical position when operating.

Next, I installed the antenna on the 18" pipe. The antenna bracket was installed as high as the U-bolts would allow, to prevent the mounting pipe from interfering with the radiation pattern.

The antenna can now be lowered by holding the handle and the nylon cord. Once the antenna is in the horizontal position, the handle can be slid forward with the cord and fastened to prevent sliding back during travel.

The advantages of the "sliding handle" are obvious when observing the rear overhang of the handle before being slid forward. When lowering the antenna for travel, slide the 1/2" pipe forward and secure with the rope. Reverse the procedure for raising. You will need to install some kind of cradle on the roof for the antenna to ride in while underway.

I installed only the bracket and first antenna section while working on the roof. Once that portion was complete, the mast was folded and swiveled so that the antenna rested on a chair that was on the ground. All remaining work and tuning was done without once having to climb atop the motor home.

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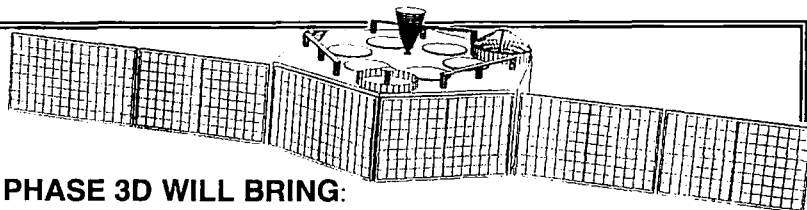


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CIRCLE 110 ON READER SERVICE CARD

Make Sure It's Grounded

While this is not a technical article, there are three things that are very necessary to an efficiently operating mobile antenna of this type: ground, ground and ground.

I use 1/2" copper braid from the antenna base to the "closest possible point" to the roof or ladder in several places, and then down the ladder to the vehicle chassis. I do the same from my radio to the chassis.

Do the very best job you can with grounding during installation and forestall any future problems from that source.

The Safety Factor

Everyone needs to adhere to standard safety practices when working atop anything with ladders, etc. Be especially careful when raising the antenna. I personally know two hams who have raised their antenna into a power line. No harm came to either, but one had a "real hot" trailer for a while. **IT COULD HAVE BEEN FATAL! ALWAYS LOOK UP BEFORE RAISING THE ANTENNA.**

It's easier than you think to drive off and leave the antenna in the air. Most of the time you won't get out of the RV park before disaster strikes. A tree or a power line will get you. I know one friend who stopped at a fast-food joint for lunch, put up the antenna to check into a net, and then drove off. He got five miles down the Interstate before leaving his 75 meter coil on top of the bridge and the rest scattered all over the highway.

I had a sign made with two words: **ANTENNA DOWN?** I attach it to the steering wheel and gear selector as soon as I stop.



Photo D. Pull the 1/2" pipe all the way out with the rope, then pull down to raise the antenna. Tie off the rope to secure.

The two things I wanted most from this tilt-over/swivel mount were versatility and convenience. I got both. I put the clock on myself once when pulling into a rest stop and wanting to check into the RV net. I started the clock when I put the gear selec-

tor in park, went to the rear of the motor home and raised the antenna, got back in the driver's seat, keyed the rig and stopped the clock. Time elapsed: 30 seconds.

The next thing I did was to hang my "ANTENNA DOWN?" sign.

73

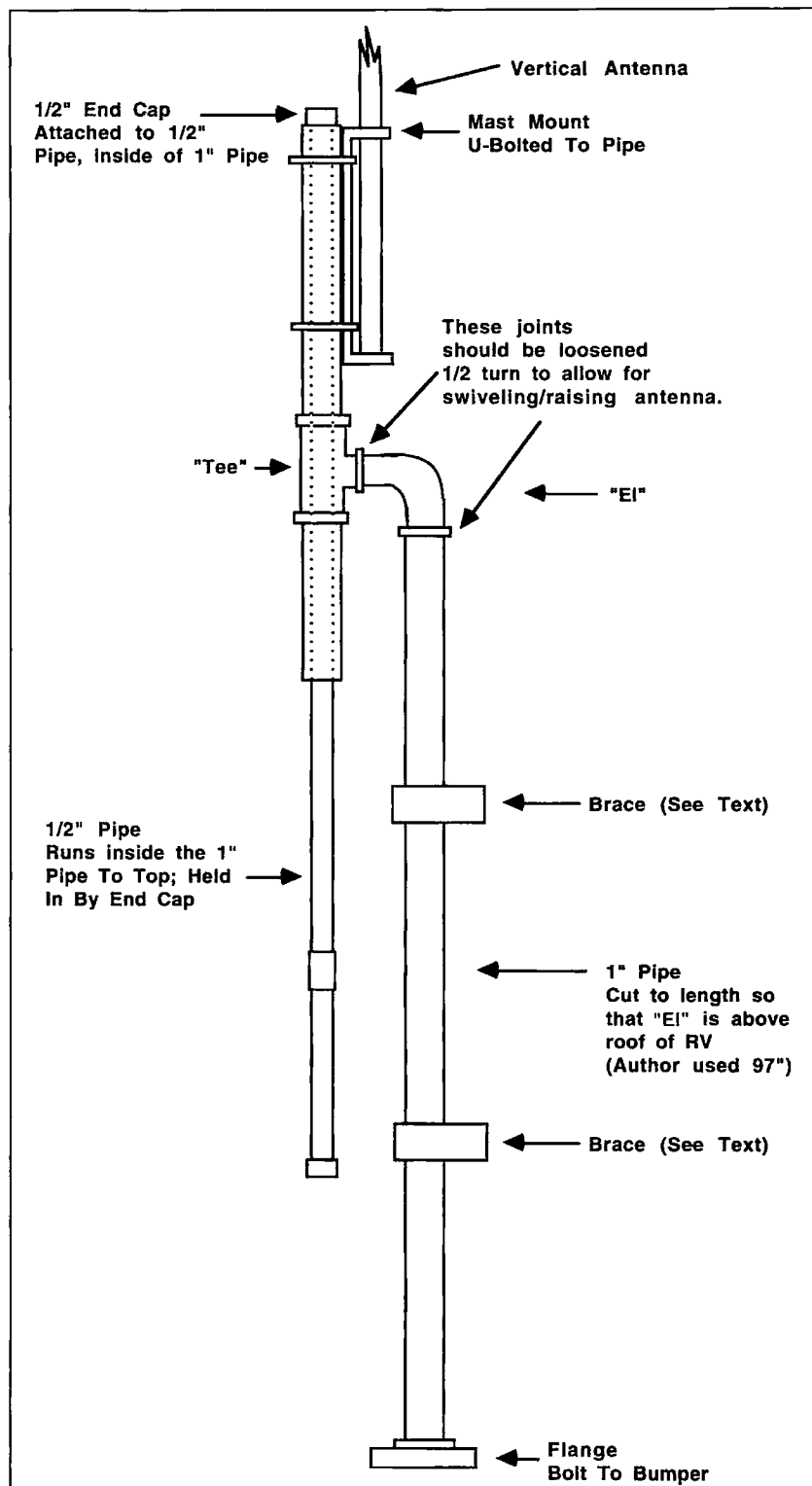


Figure 1. Construction details of the RV antenna mount.

Expanded Range Direct-Reading Inductance Meter

Build this cheap choke checker.

by Arthur C. Erdman W8VWX

The inductance meter I described in the January 1992 issue of *73 Amateur Radio Today* works well but it is limited to about 10 to 250 μH . The basic circuit creates a pulse, the width of which is directly proportional to inductance. A digital voltmeter (DVM) reads the average value of the pulse train. Readers have inquired about how to extend the range to lower and higher values. Much thought and experimentation provided an answer: Place the unknown inductance in series with a known inductance. This avoids having the circuit inductance approach zero at the low end of any scale. Also, the range of linearity is narrowed, making the circuit quite practical.

As a specific example, I used a fixed 10 μH inductance on the "0" to 25 μH range. Now the circuit sees 10 to 35 μH .

The pulses never get vanishingly narrow. Insert a 100 μH for the 0 to 250 μH range and, finally, use a 1,000 μH for the 0 to

2,500 μH range. See Figure 1.

These inductors (5% tolerance) are available for less than \$1 each from Mouser Elec-

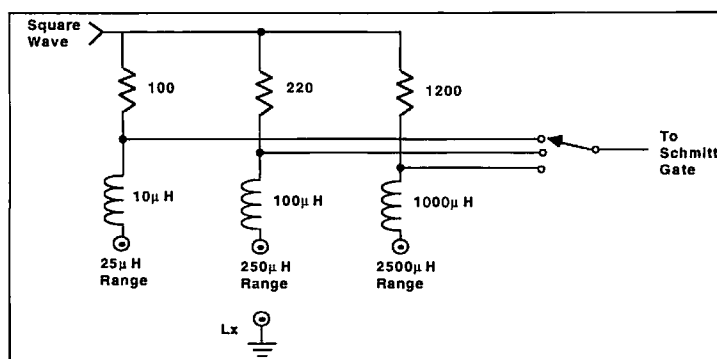


Figure 1. Basic measuring scheme.

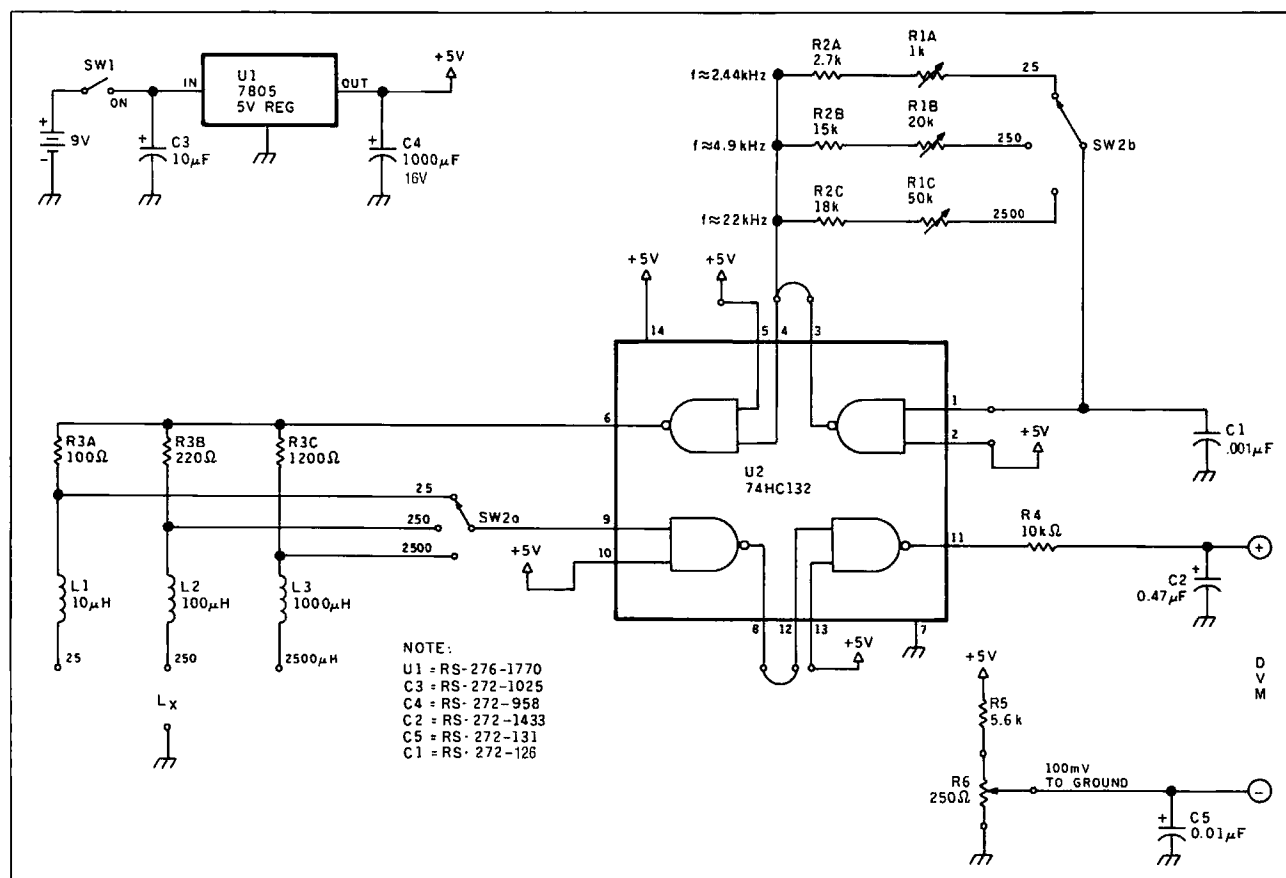


Figure 2. Schematic for the expanded-scale direct-reading linear inductance meter.

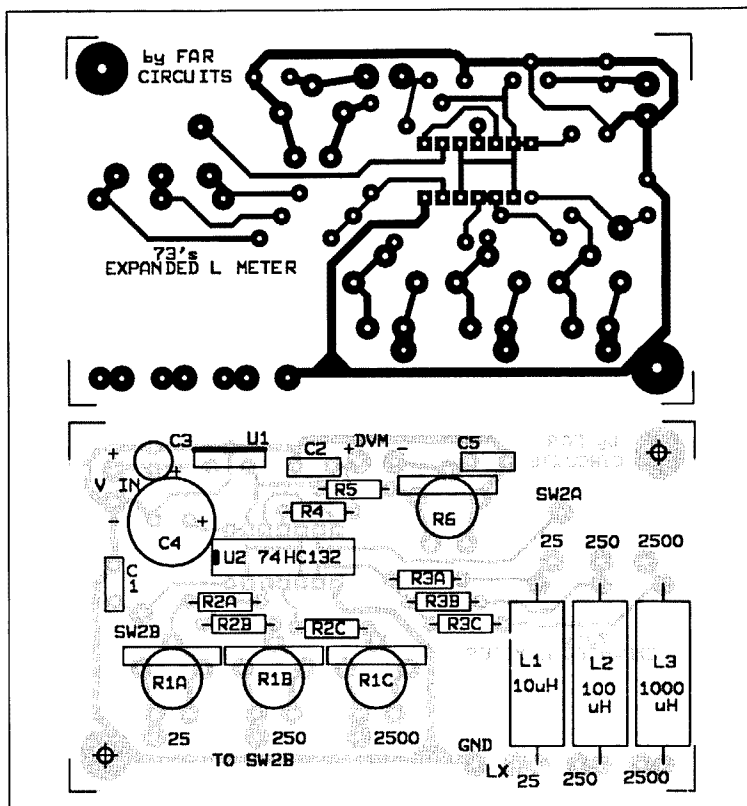


Figure 3. PC board pattern and parts placement for the expanded-scale direct-reading linear inductance meter.

tronics. The offset voltage due to this method of measurement is simply counteracted by a bucking voltage.

Linearity is excellent because the greatest change in pulse width on any range is only 3.5 to 1. Without the series inductance, the linearity must be over a much greater range. For example, without the series inductance, the "0" to 250 μH range would never reach "0" because the pulse would be too short to pass through the gates. If 10 to 250 is readable, the linearity must be over a 25 to 1 range.

The following indicates the scale resolution:

- 1) 0 to 25 μH ; 10 mV/1 μH

- 2) 0 to 250 μH ; 1 mV/1 μH

- 3) 0 to 2,500 μH ; 1 mV/10 μH

Circuit limitations prevent the 0 to 2,500 μH range from having greater sensitivity. Figure 2 indicates the complete circuit.

Construction

To avoid switching of the critical inductances, I elected to have a separate jack for each range. I am always trying out different circuits (and values) so I seldom use a printed circuit. The most convenient approach that I've found is to use an "experimenter's plug-in board." Radio Shack carries these. They are listed as "Solderless IC Breadboards." I used their board, catalog number

276-175, approximately 2" x 3-1/2", with 270 connecting points. Number 22 wire fits snugly into the holes. So do 1/4 watt resistor leads, most capacitor leads and best of all, integrated circuit legs.

Drilled and etched PC boards are available for \$4.25 plus \$1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

Tune-Up

(The L meter and DVM power supplies *cannot* be both AC line powered or the bucking voltage will be shorted out due to common grounds.)

1. Adjust the bucking voltage to 100 mV. To do this, connect the DVM from the read-out negative terminal to ground (chassis).

2. On each range, short the L_x terminal to ground and adjust the proper pot for 0 volts at the read-out terminals. That's all that is required.

If you discover that inserting a known inductor in the circuit produces a slight error on the read-out, remember that your standard is only within 5%. Coils in the 250 to 2500 μH range have widely varying DC resistance, causing linearity errors. Iron core coils read truer due to less wire resistance than air core coils of equal inductance.

Parts List

R1A	1k ohm pot	
R1B	20k ohm pot	
R1C	50k ohm pot	
R2A	2.7k ohm	
R2B	15k ohm	
R2C	18k ohm	
R3A	100 ohm	
R3B	220 ohm	
R3C	1200 ohm	
R4	10k ohm	
R5	5.6k ohm	
R6	250 ohm pot	
C1	0.001 μF	RS272-126
C2	0.47 μF	RS272-1433
C3	10 μF	RS272-1025
C4	1000 μF 16V	RS272-1025
C5	0.01 μF	RS272-131
U1	7805	RS276-1770
U2	74HC132	
L1	10 μH choke	
L2	100 μH choke	
L3	1000 μH choke	

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Deluxe Function Generator

This simple project has many uses.

by David Cripe KC3ZQ

A function generator is one piece of equipment found in the lab of nearly every electronics technician and engineer. In conjunction with an oscilloscope, a function generator can be used to test or troubleshoot most gear found in the hamshack. Unfortunately, commercial function generators are priced well out of the range of most hams, and good used ones don't often appear at hamfests. Consequently, I decided to design my own! This simple, low-cost function generator features TTL, square-wave,

triangle, and sine-wave outputs, and portable battery operation.

Design

I started out by defining the features I wanted. This project had to be low-cost, using commonly available parts. It had to be portable, operating from batteries. It needed to have a TTL output for testing logic circuits, as well as variable-amplitude square, triangle, and sine-wave outputs. The sine wave output must be relatively pure, with

the amplitude of the harmonics less than 1% of the fundamental frequency. The frequency range of the function generator had to cover 100 hertz to 10 kilohertz, which would include most of the audio range. After a few hours of breadboarding I arrived at a circuit which met all of these requirements.

See Figure 1. This is a fairly simple design using only three ICs. All of the parts are available at your neighborhood Radio Shack, or from any well-stocked junk box.

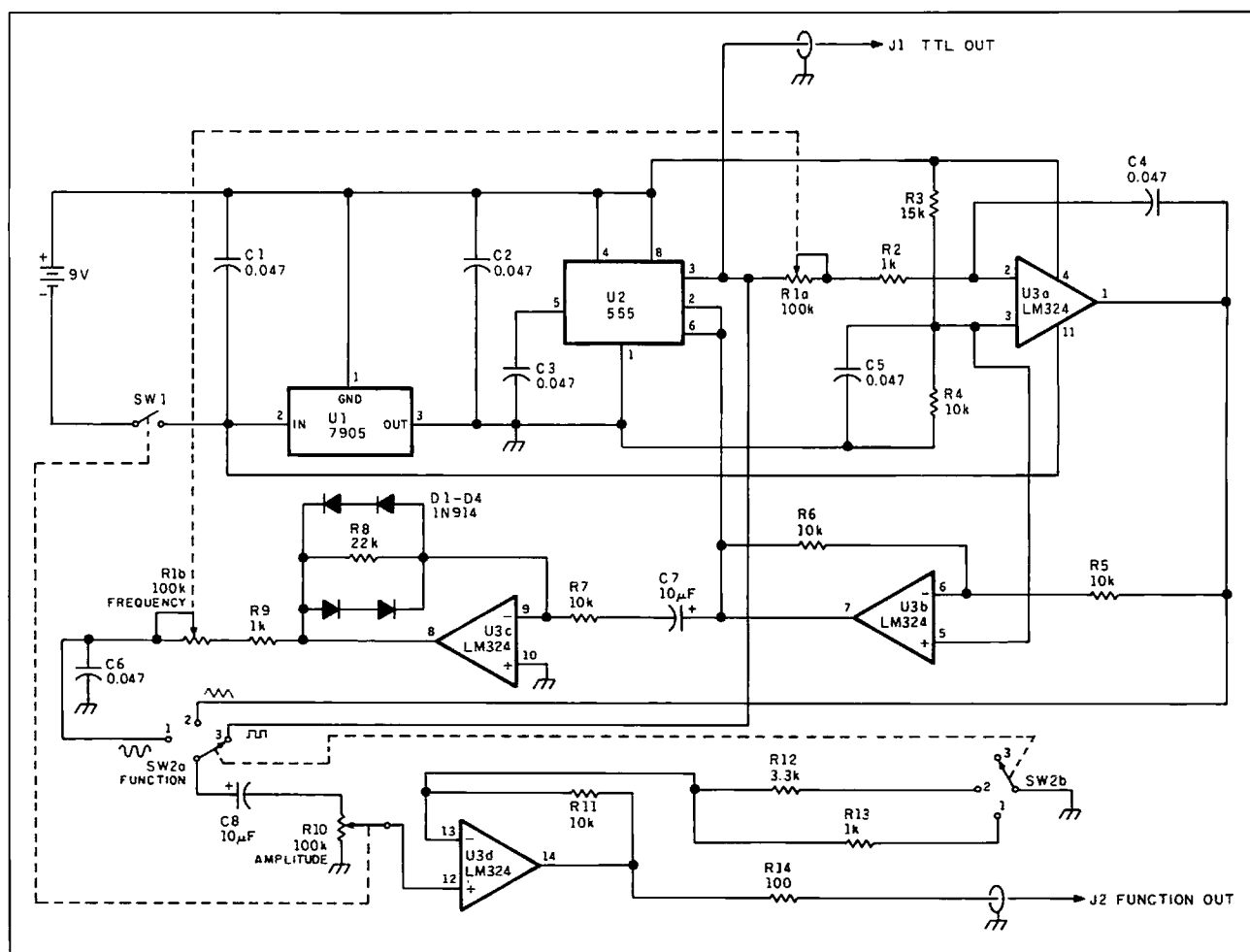


Figure 1. Schematic for the Deluxe Function Generator.

The circuit can be built conveniently on one of Radio Shack's solder-pad breadboards, such as their part #276-168, or you can purchase an etched and drilled PC board from FAR Circuits, 18N640 Field Court, Dundee IL 60118 (\$4.50 plus \$1.50 S&H).

After mounting the circuit in a folded aluminum box, I found its small size and portability made it easier to use than any of the commercial function generators I was familiar with. I actually ended up taking it to work with me to use at my job for those applications where portability is preferred over accuracy. I am now building my second one!

The heart of the function generator is a U2, a 555 timer. These ICs are tremendously useful devices, with high-current outputs, capable of driving TTL loads. It is configured as a somewhat unconventional square-wave oscillator in this circuit. The square-wave output of U2, pin 3 of the 555, is integrated by U3a, one section of an LM324

quad op amp, producing a highly accurate triangle wave. This waveform is then buffered and inverted in U3b, and fed back into pins 2 and 6 of the 555, its trigger and threshold inputs, respectively. This causes U2 to produce its square-wave oscillation. The frequency of oscillation is determined by R1a, one section of a 100k stereo volume control pot.

We now have a circuit which generates a square wave and a triangle wave. Obtaining a sine wave is a bit more difficult. Those of us who had a little math in college may remember some theorems from a fellow named Fourier, telling us that if we take a sine wave and add its third, fifth, seventh, ninth, etc., harmonics at the correct levels, we come up with a triangle wave. Conversely, low-pass filtering the harmonic components from a triangle wave should leave us with a sine wave. It turns out that if we clip the upper and lower 33.3% off of the peaks of a triangle wave the resultant trapezoidal waveform contains no third harmonic energy. Passing this waveform through a simple, one-pole low-pass filter gives us a sine-wave of sufficient purity for our needs. Diodes D1 through D4 perform the function of waveform clipping in U3c. The low-pass filter consists of R9, R1b (the second section of the 100k stereo volume control pot), and C7. Since the cutoff frequency of this filter, controlled by R1b, tracks the oscillator frequency, the sine wave output of has a nearly constant amplitude over its frequency range. This sine-wave is very pure, with no harmonic higher than 1% of the fundamental.

The last section of U3 is used as a buffer amplifier for the function generator output.

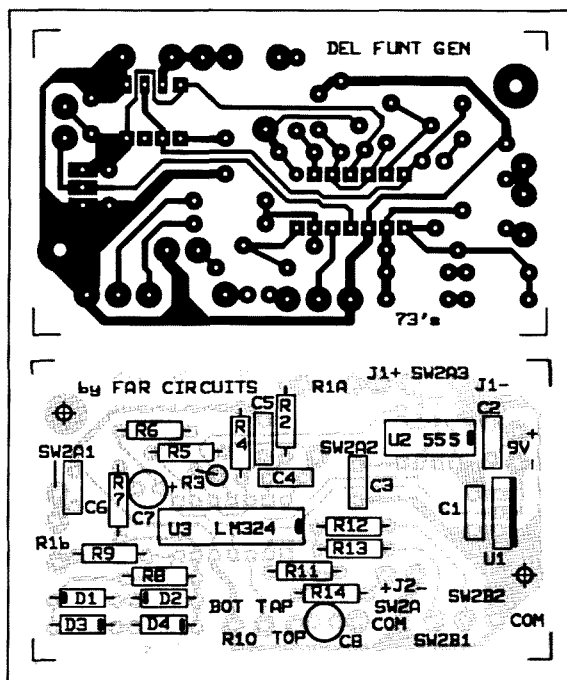


Figure 2. PC board pattern and parts placement.

Switch SW2a, one section of a two-pole, three- (or more) position switch, is used to select the square, triangle, or sine wave to be buffered. The gain of the buffer is set by R10, a 100k log taper volume control pot. The circuit on/off switch SW1 may be integrated into R10. Since the amplitude of the square, triangle, and sine waveforms at SW2a are not equal, the second section of SW2 is used to scale the gain of the U3d buffer so that the amplitudes of the three waveforms are roughly equal at the output.

A 7905 voltage regulator, U1, creates a stable 5 volt source for the 555, as well as the split (+5, -4 volt) supply required by the op amp.

Give this project a try. I can think of worse ways to spend a rainy weekend afternoon than building a simple, inexpensive project that has as many uses as this one.

Parts List

C1-C6	0.047 µF	272-134
C7,C8	10 µF	272-1025
R1	100k stereo volume	271-1723
R2,R9,R13	1k, 1/4W	271-1321
R3	15k, 1/4W	271-1337
R4-R7,R11	10k, 1/4W	271-1335
R8	22k, 1/4W	271-1339
R10	100k audio pot	271-1772
R12	3.3k, 1/4W	271-1328
R14	100 ohm, 1/4W	271-1311
D1-4	1N914, 1N4148 etc.	276-1122
SW1	SPST pot switch	271-1740
SW2	2-pole, 6-position	275-1386
U1	7905 -5V regulator	See Note 1
U2	555 timer	276-1723
U3	LM324 quad op amp	276-1711

Note 1: The 7905 regulator is not normally stocked by Radio Shack, although it can often be found in their "Regulator Assortment" 276-1660. It's also generally stocked by most mail order houses.

Drilled and etched PC boards are available from FAR Circuits, 18N640 Field Ct., Dundee IL 60118 for \$4.50 plus \$1.50 S & H.

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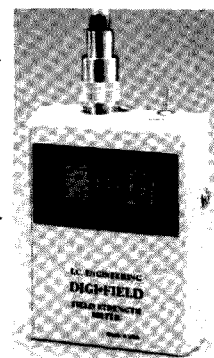
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CIRCLE 293 ON READER SERVICE CARD

A Universal Speech Processor

An easy upgrade for your transceiver.

by Bob Roehrig K9EU1

Most of the more expensive HF transceivers today have some form of speech processing. Less expensive rigs have either marginally effective processors or none at all.

Older radios, especially tube-type units such as Drake, Swan, and Collins, do not have any processing at all. Over-modulation protection, if any, is accomplished by means of an ALC circuit. Many hams (believing that ALC is to be used as a form of compression) drive their units well up into the ALC region on the meter. Some rigs that have ALC have no means to monitor its operation. ALC is intended only to protect from over-modulation on occasional peaks. The ALC indicator should just barely show action once in awhile. An ALC circuit is not a substitute for a speech processor.

Unless you have a fancy "high-end" rig with a decent internal processor, it is well worth the time to construct an outboard unit. QRP enthusiasts who operate SSB can get the most out of a low power rig with the use of an effective processor.

Construction

The unit described here is an easily-assembled processor that can be used with any rig available today. Its small size even makes it possible to install the unit inside some rigs, rather than in a separate box.

I chose to build my processor in a mini-box so it could be used on several rigs. (I also plan to add a keyer circuit for CW in the same box.) The circuit was assembled on a small piece of "hobby board" from Radio Shack. A drilled and etched PC board for this project is available for \$4.25 plus \$1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

The input circuit of the processor consists of an op amp with a voltage gain of 10 and has an input impedance of 100k. This should accommodate almost any type of microphone in use. The output of this stage is adjusted by R5.

Diodes D1 and D2 rectify the audio signal. The DC voltages are filtered by C3 and C4. These capacitors also determine the time constant of the circuit. The voltage from the rectifiers is applied to diodes D3 and D4 to forward bias them. These diodes act as variable impedance devices. The higher the voltage applied to them, the more they "turn on," shunting more of the audio signal to ground.

Capacitors C5, C6 and C7 isolate the DC levels from the audio portion of the circuit.

The output amplifier performs two functions: It has a gain of 10 to make up for losses in the processor part of the circuit, and also transforms the relatively high impedance of the processor to a lower impedance so the processor cannot be loaded down. R13 is the output level adjustment.

Power decoupling is accomplished by R14 and C9. R1 and R2 form a voltage divider to properly bias the op amp inputs at half the supply voltage. The supply voltage is not critical. Anything between 6 and 24 volts can be used. Stage gain remains constant, regardless of supply voltage. The supply must be well filtered to eliminate hum. With a 12 volt supply, the average current drain is only 2 mA, so the unit can easily be powered from a small 9 volt battery.

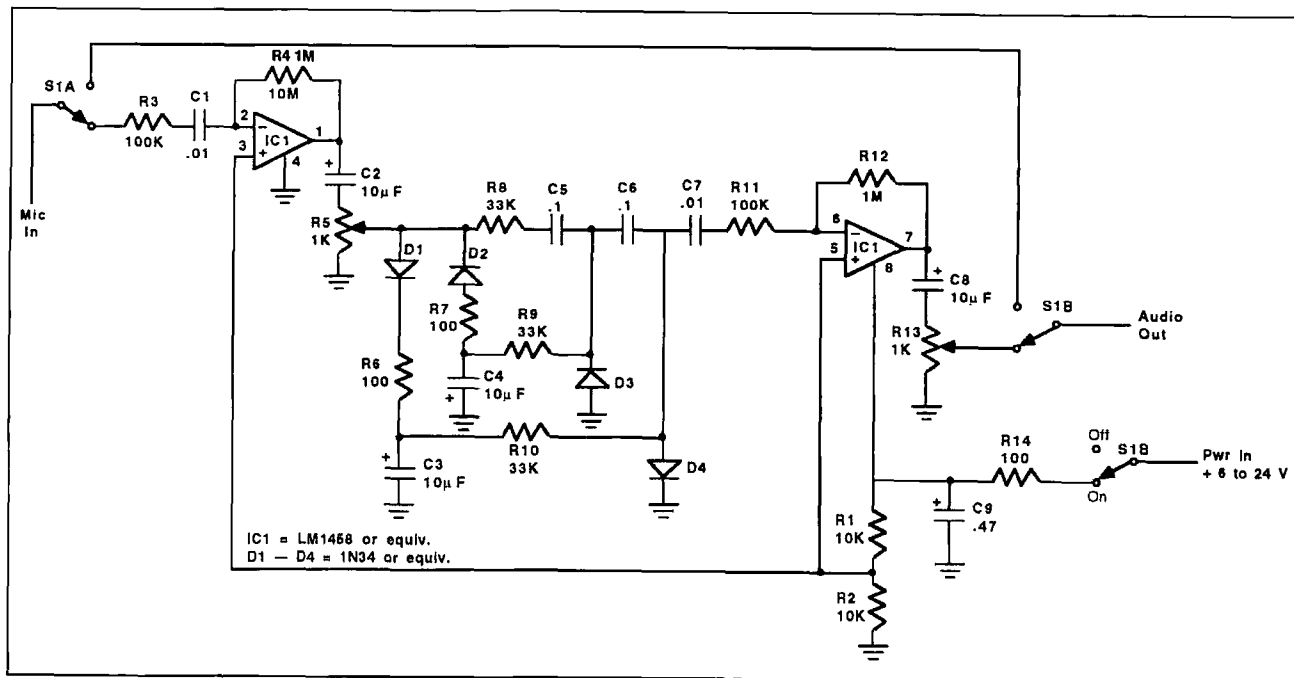


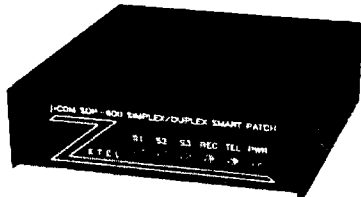
Figure 1. Schematic for the Universal Speech Processor.

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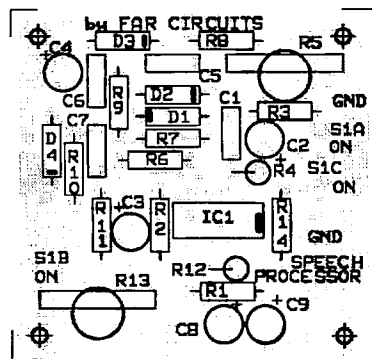
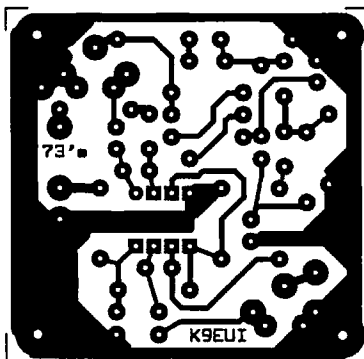


Figure 2. PC board pattern and parts placement for the Universal Speech Processor. A drilled and etched PC board for this project is available for \$4.25 plus \$1.50 S & H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

Adjustment is best performed with the aid of a scope but can also be done with a high impedance meter (VTVM or FET input meter or DVM).

Connect the scope to the output (wiper) of R5, or connect the meter across C3. When the word "FOUR" is spoken into the mike at a slightly lower than normal level, adjust R5 so the scope indicates about 200 mV peak-to-peak, or the meter reads about 50 mV. At a normal level the scope should not peak over 2 volts peak-to-peak, or the meter should be less than 1 volt.

Compression starts at about a level where the meter reads 50 mV. At levels above 100 mV the output remains constant. With a sine wave applied to the input, the output remains sinusoidal until the voltage across C3 reaches about 3.5 volts. In other words, with a variation of from 1 to 6 volts peak-to-peak at the output of R5, the output level remains constant and does not clip.

R13, the output control, is adjusted so that with normal speech the mike gain control on the rig is at its normal position.

A word of caution here. While there is a constant output level for an input variation of 30 dB with a signal generator source, this does not mean you can operate your rig so its meter reads maximum output. A signal generator is not the same as speech! Because the attack time of the processor is not instantaneous, there is some overshoot at the beginning of

speech input. Final analysis should be done with the aid of a scope that is monitoring the RF output of the rig. Unless you can determine peak modulation levels in this manner, do not hit peaks as indicated on your rig's meter, greater than half your normal maximum available power.

In addition to increasing the average modulation percentage, this processor also helps intelligibility by tailoring the frequency response. At 300 Hz, the response is down 6 dB. Low frequencies in the voice range waste energy and should be reduced, especially if you have a bassy voice.

Signal Quality

I have found that it is very difficult to get valuable information about the quality of my signal from anyone listening to it. If you tell someone that you are using a processor, chances are they will tell you it sounds bad no matter how well it is working.

A good way to judge the quality of your signal is to operate the rig into a dummy load and pick it up on another receiver. If necessary, attenuate the RF signal into the receiver so it stays below S-9. Record the received signal on a good quality tape recorder and listen to the results. Reduce the RF level into the receiver to S-5 or less and record the results again, with and without the processor, for comparison. If you are pleased with the results, so should everyone else who hears you.

Parts List

Component	Description	Radio Shack #
IC socket	8-pin DIP	276-1995
IC1	1458 Dual Op Amp	276-038
D1-D4	1N34 or equiv.	276-1123
C1, C7	0.01 µF	272-1065
C5, C6	0.1 µF	272-1069
C2, C3, C4, C8	10 µF	272-1436
R1, R2	10k	271-1335
R3, R11	100k	271-1347
R4, R12	1 MEG	271-1356
R5, R13	1k pot	271-280
R6, R7, R14	100 ohms	271-1311
R8, R9, R10	33k	271-1341

Stacking UHF Antennas

Get gain with less pain.

by Ronald Baker WB4HFN

Venturing into amateur television or "ATV" for the first time presented me with new and exciting challenges. Not only was I operating at unfamiliar frequencies; I also had to deal with the greater bandwidth needed for video transmission. The most important consideration for me was the antenna system.

Towers and large obtrusive antennas are not allowed in my subdivision. Next to a good antenna system, overall height is the most important factor. For my application, height was not a problem since I live on a hilltop several hundred feet above average terrain. My problem was to design a good antenna system that would be physically small and still provide adequate gain.

Design

In talking with other hams operating ATV, the general recommendation was: "The higher the better, using the biggest antenna you can rotate." Antenna-wise, most of the operators were using antennas with gains of 13.5 dB to 18 dB. Researching various antennas, I found that for the required gain the boom length is 10 to 20 feet. That length would be too obtrusive for my neighborhood. To solve this problem, I set out to design and build an antenna system that would give me a minimum of 14 dB gain with an overall boom length of under five feet.

Not knowing a lot about VHF/UHF antenna design, I first looked at various antenna manufacturers and discovered that Cushcraft makes a beam that covers the 430 to 440 MHz band, with 11.5 dB gain, and a boom length of four feet. It seemed to fit my requirements, except for the gain.

I erected a system using this antenna and found that it performed well, but the lack of gain was very noticeable. The antenna match right out of the box was almost perfect. I measured very low standing wave or reflected power with a Bird model 43 wattmeter at 432 MHz. At this point, the on-

ly thing I needed was more gain. One way to quickly get an additional 3 dB would be to stack two antennas together. Since the antennas are vertically polarized, stacking would eliminate the need for a Fiberglass mast. Normally, a metal mast going through a vertically mounted beam tends to distort the radiation pattern and can affect the overall gain, especially at VHF/UHF frequencies.

There are many different types of UHF beams on the market today, but most are not

the 430 to 440 MHz range. This is the SSB portion of the band and is shared with the upper half of the ATV band. This segment of the band is usually where you will find ATV repeater input frequencies, which will present a good match to your ATV transmitter.

Signal loss in the 420 to 430 segment was noticeably greater. This segment is usually reserved for the ATV repeater transmitters, which have the signal advantage over an individual station. Also, receive signal loss can be further minimized by using a good RF preamp, preferably mast-mounted. Most ATV operators will tell you that using a good RF preamp is essential, no matter what type of antenna design you use.

When it came to stacking UHF antennas, I thought it a simple matter to mount two antennas, hook up a phasing harness, and attach the feedline, WELL . . . ALMOST! Mounting the antenna was a simple task. Using a "T" configuration mast I mounted the antennas on each end with 26 inches separation, as specified by the manufacturer. The actual separation between antennas varies with the type of antenna and boom length. Figure 1 shows the overall construction.

The antenna phasing harness presented an interesting challenge. I had two options for a harness: Purchase one or construct my own. Spending \$50 for a ready-made harness consisting of four coax connectors, one "T" connector, and a few

feet of RG-59, was totally out of the question. Not knowing much about phase harness construction, I hit the books for information. I was surprised to find little information available, and what I did find was vague, with no clear-cut answers. I even contacted the antenna manufacturer where I received a few suggestions, but again nothing definite.

With all the discussion and reading, I was able to determine the length of the cable. The cable from the "T" connector to the an-

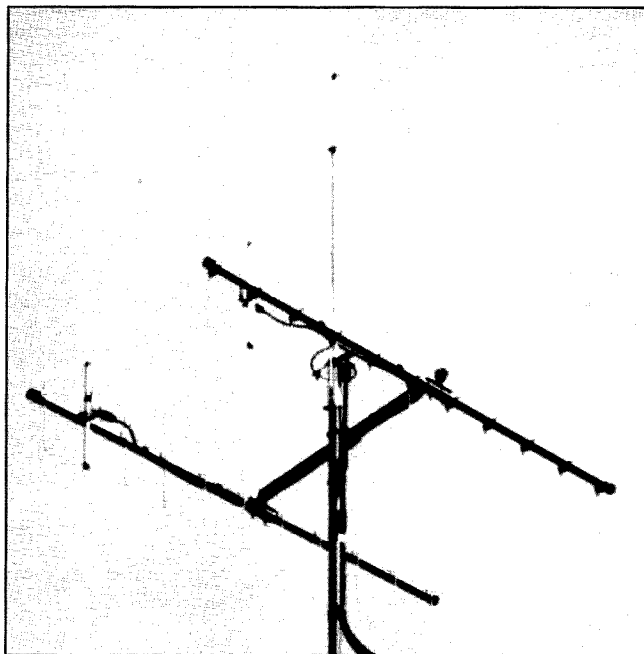


Photo A. The stacked UHF antennas.

suited for ATV operations. Most commercially available antennas are designed for the FM portion of the band between 440 and 450 MHz. This type of antenna works well at the designed frequencies, but performance in the 420 to 430 MHz region is compromised because the element length is too short for a proper match. Operating ATV, you will quickly learn that every dB of gain or loss affects picture quality. The Cushcraft model 432-11 antenna is still a slight compromise because it's designed to operate in

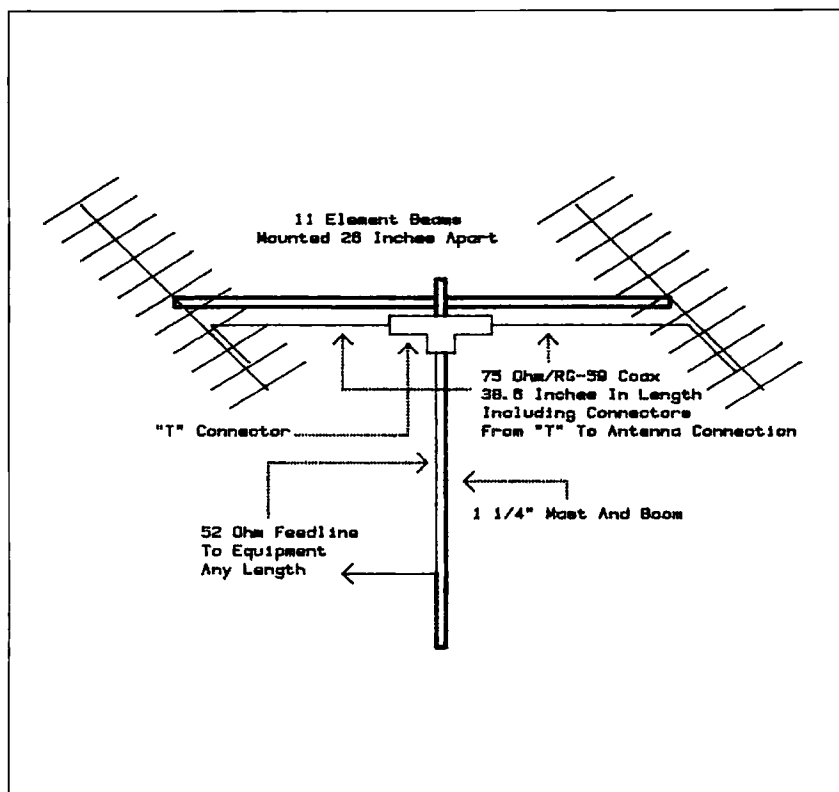


Figure 1. Final assembly detail.

tenna must be an odd multiple of a quarter wavelength, minus the length equal to the propagational delay of the cable. Propagational delay is a comparison expressed as the percentage of the time it takes for signal to travel through coax to the time it takes to travel the same distance through free space.

The cable length, including connectors, must be the same on both sides of the "T" connector. The feedline to the "T" connector from your equipment can be any length.

For example, let's use the frequency 432 MHz and RG-59 75 ohm cable.

Our formula is: $CL = MQW \times PPD$

CL = the length of the coax cable in inches, including connectors from the "T" connector to the antenna.

MQW = the odd multiple of a quarter wavelength in inches, at the operating frequency.

PPD = the coax propagational delay, which for RG-59 is 85%. In the formula this number is expressed as a decimal number.

First, determine the quarter wavelength of the operating frequency using the formula:

Quarter wavelength in inches = $2808 / \text{frequency in MHz}$

In our example: Quarter wavelength = $2808 / 432$

Quarter wavelength = 6.50 inches

Next, determine the length of coax needed between the "T" connector and the antenna. For my project I needed a minimum of 35 inches of cable to make the connection from the "T" connector to the antenna. I chose to use the seventh multiple, which gave me an

overall length of 45.50 inches. Next, we multiply this number by the coax propagational delay of 85 percent, as shown below.

$CL = MQW \times PPD$

$CL = 45.50 \text{ inches} \times 0.85$

$CL = 38.67 \text{ inches}$

As shown in our formula, the proper coax length for the phasing harness is 38.67 inches from the "T" connector to the antenna. This measurement is tip-to-tip, with connectors as shown in Figure 2.

Tuning

Tuning the antenna system is a simple task. You must use a power meter or SWR bridge designed for UHF, such as the Bird Model 43. The meters designed for HF and even 2 meters are usually not accurate at UHF frequencies.

After the antenna system has been assembled and mounted on the "T" shape boom, tune both antennas individually for minimum reflected power or SWR. In this step the coax from your equipment is connected directly to the antenna. The phasing harness is NOT connected.

After both antennas are properly tuned individually, connect the phasing harness to the antennas as shown in Figure 1. If everything is tuned properly and the harness is cut correctly, the SWR should still be good, but slightly higher than the reading you had with each antenna individually. At this point, all further adjustments to fine-tune the antenna array can be made by adjusting only one antenna. It doesn't make a difference which one you use to make the adjustments—the important thing is to adjust only one antenna. I tried various methods of adjustment and found that this method works the best.

Overall antenna performance in the upper portion of the band was very good, considering the antenna's size. The manufacturer antenna gain specification for this design was 16.8 dB. Even though I feel this may not be a realistic figure, there was a definite improvement over a single antenna of the same type. In comparing this design with the larger ATV antennas, it performed very close to the antennas in the 10 to 14-foot range that give between 14.2 to 14.8 dB gain.

If you need a good antenna system on ATV and have space limitations, this design works well. At UHF frequencies, height above average terrain is extremely important. Even the best antenna system performs poorly if you're looking into trees, hills or nearby structures.

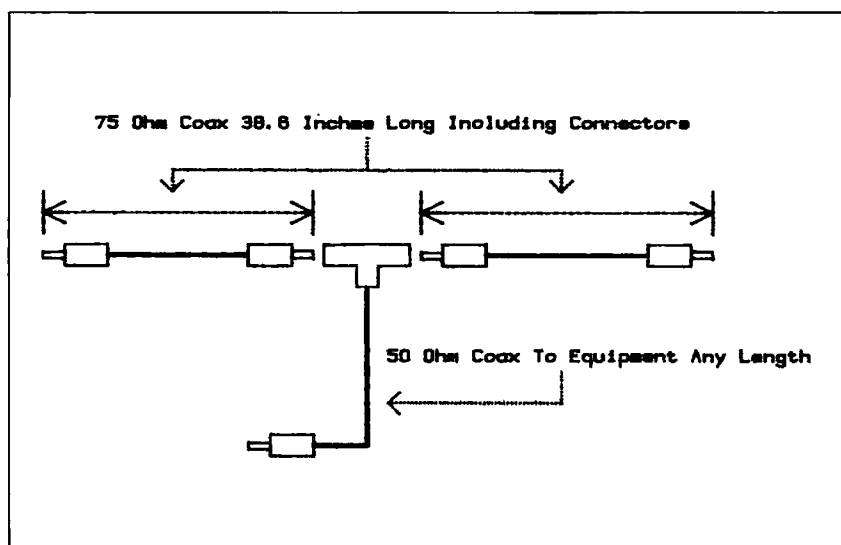


Figure 2. Phasing harness detail.

Nine to 10

What to do when 10 meters is closed.

by Paul M. Danzer N1II

Just a few short months ago many of us were routinely talking to Europe or Asia with our low power 10 meter mobile rigs as we commuted back and forth to work. Then there were more and more days where our favorite DX friends were too weak to copy, and then more and more days when they could not be heard at all.

The culprit, of course, is the 11-year sun-spot cycle. At the peak of the cycle, which occurred a few years ago, 5 to 25 watts on 10 meters was enough to cover much of the world. Now that we are going down towards the low part of the cycle, more and more often nothing can be heard: "The band is dead."

Leave Your Rig in the Car

The temptation is to say OK—if 10 is dead I might as well take the rig out of the car. But 10 is a funny band; closed one day and suddenly open the next. Quiet one minute and full of DX the next, as the sun erupts and quiets down.

Instead of taking the rig out of the car, you could try to find a use for it when 10 is closed. The converter shown in block form in Figure 1 does just that.

10 May Be Closed but Other Bands Are Open

The 10 meter band extends from approximately 28 to 30 MHz. Your 10 meter rig has a very sensitive and selective receiver. Figure 1 shows a converter which can be built in just one evening. It allows the receiver to cover a shortwave band. This way, when 10 is closed you can monitor a shortwave band instead of the "golden oldies" played on your local broadcast station.

The 9 MHz shortwave band is a good choice. Open at all hours in most places to some part of the world, it is a compromise between the higher shortwave bands (13, 15, 17, and 19 MHz), which tend to be closed at night during this part of the sun spot cycle, and the lower shortwave bands (7 and 6 MHz), which are usually closed during the day.

Picking the 9 MHz band has another advantage—you get the 8 MHz ship band (including weather, telephone calls, and

inter-ship messages) which can also make for very interesting listening.

How Does It Work?

Figure 1 shows the flow of signals in the converter. Your 10 meter antenna is connected to an input network (to be discussed later). A single field-effect (FET) transistor, Q2, acts as an oscillator at 20 MHz. A second FET is used as the mixer. Stations in the frequency range of 8 to 10 MHz go through the input network into the mixer, which adds 20 MHz to their frequency. Thus, a station on 9.1 MHz comes out of the mixer at 29.1 MHz ($9.1 + 20 = 29.1$).

The result is that the marine (ship) frequency band in the range of 8.2 to 8.8 MHz is converted to 28.2 to 28.8 MHz, and the shortwave broadcast band of 9.5 to 9.9 MHz is converted to 29.5 to 29.9 MHz. Don't be surprised to hear shortwave broadcasts outside of these limits since not all countries play by the rules!

Two FETs and One Crystal Do It All

Figure 2 shows the schematic for the converter. The oscillator consists of FET Q2 and a 20 MHz crystal (marked XTAL) in a Pierce oscillator. The circuit is simple, uses a minimum number of parts, and works well with very inexpensive crystals.

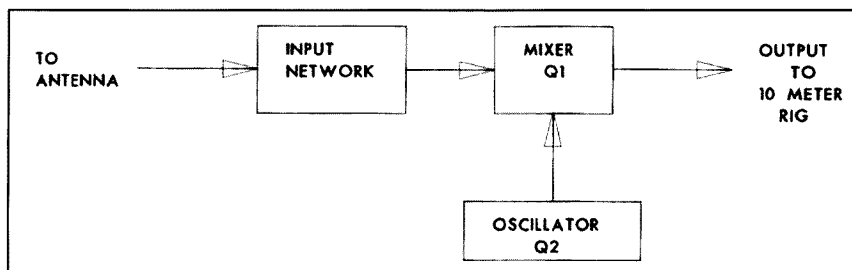


Figure 1. Signal flow.

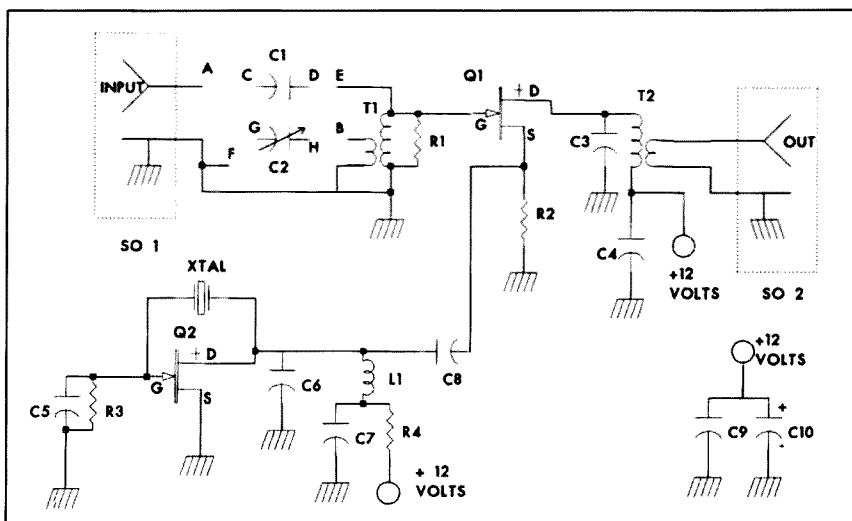


Figure 2. Schematic for the converter.

Q1, also an FET, is a source injection mixer. It produces both the sum and difference of the input signal and the 20 MHz local oscillator. The output circuit, consisting of the larger winding of T2 and capacitor C3, is broadly tuned to the sum frequency range.

We don't really want any selectivity from this circuit since we have plenty of selectivity in the 10 meter receiver connected to it.

The circuit operates from 12 volts. It would probably operate just as well from 9 volts, but since your car supplies 12 volts, that voltage is used. C9 and C10 are bypass capacitors to clean up the 12 volt line a little bit on the converter board.

The Input Network

When your 10 meter rig is connected to your 10 meter antenna and the standing wave ratio (SWR) is low, the antenna looks like a 50 ohm source plugged into a 50 ohm receiver input. However, your 10 meter antenna, when measured at the end of a transmission line, can look like just about anything you can imagine when it is measured at 9 MHz.

That's exactly what we are doing with

this converter—trying to use a 10 meter antenna at 9 MHz. Therefore, as the schematic (Figure 2) shows, the input connector (SO1), two capacitors (C1 and C2), and the input transformer (T1) are important.

These components can be connected in several ways (see Figure 6) to get the maximum signal from the antenna to the converter, and the connection of these parts is part of the simple tune-up process.

Build It in One Evening

The original model of this converter was built on a breadboard unit available from Radio Shack (part #276-174, the Experimenter's Socket). The layout is not critical. The oscillator is built on one end of the breadboard unit, with the converter on the other end. It can also be built on perf board fit with standard "flea" clips if they are available.

But, the best way to construct the unit is with a printed circuit board. Figure 3 shows the layout of the board and the parts placement diagram. The board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118, for \$3.50 per board plus \$1.50 shipping and handling per order.

T1 and T2 are made from 100 μ H chokes (Radio Shack #273-102). Each choke comes wound with two layers of wire. Only 20 turns of wire are needed for the large winding

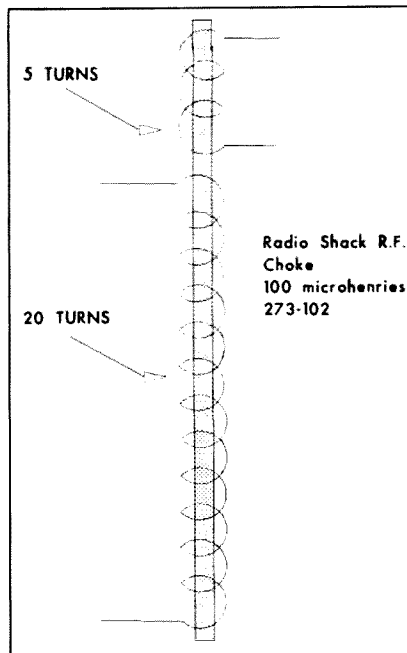


Figure 4. Choke winding diagram.

in T1 and T2, so strip off the excess wire until only 20 turns are left, and then reconnect the free end of the wire.

Take the surplus wire you have cut off and wind five turns for the second winding. Twist the leads to the five turns together to keep them from unraveling. Don't be overly concerned about how neat these transformers look—they do not have to be very precise.

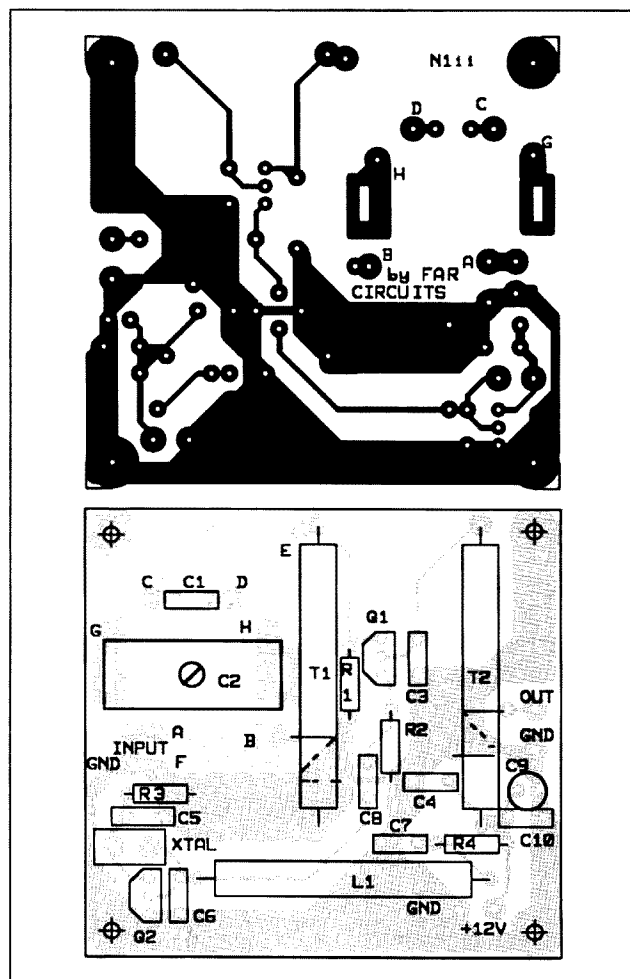


Figure 3. PC board and parts placement diagram.

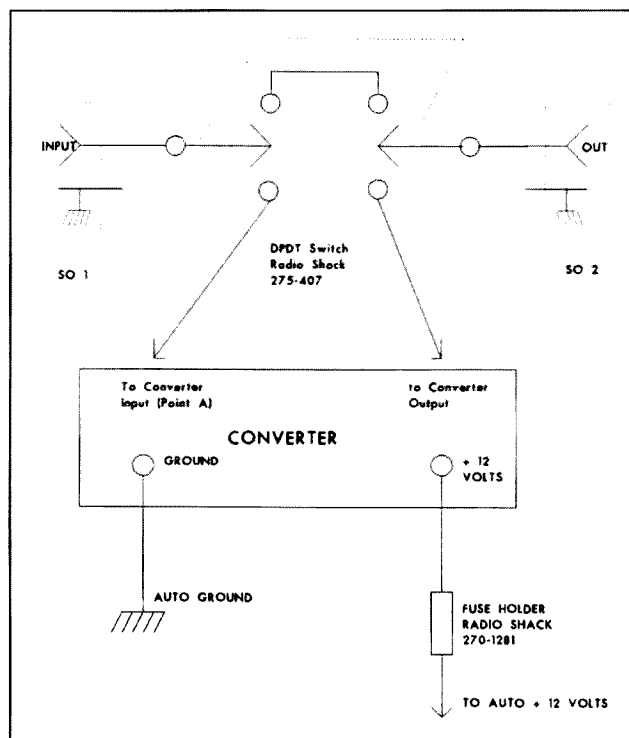


Figure 5. Set up the converter in your car.

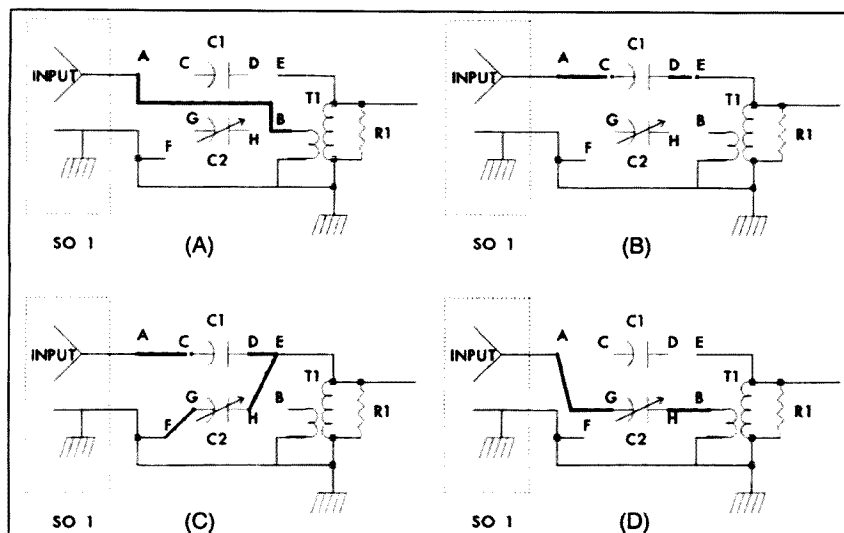


Figure 6. Tune the converter by configuring these jumper wires as shown for best results.

According to the Parts List, C5 is a 4.7 pF. Occasionally you might run into a crystal which does not want to oscillate with this value. In that case wire two identical 4.7 pF capacitors in parallel in place of the single unit.

Plug It In

The converter is connected by removing the antenna lead from your 10 meter rig and connecting the lead to SO1. A new piece of coax with connectors is used to connect the output of the converter at SO2 back to the input connector on the rig. Fi-

nally, the 12 volt input of the converter is connected to a 12 volt source in the car.

It is best to connect the 12 volts through a fuse. The converter draws only a few milliamperes so the fuse will only serve to protect you from a major short circuit. An in-line fuse holder, such as Radio Shack #270-1281 with a 1/4 ampere fuse, will do the job nicely.

If you wish, you can wire the converter with a double-pole double-throw switch, such as that shown in Figure 5. This would allow switching the converter in and out of the antenna line without the bother of removing the antenna line and reconnecting it.

When the converter is connected,

make sure that you do not key your microphone! Transmitting with the converter in the line will probably result in blowing transistor Q1.

Tuning it Up

There is no real tune-up process except for the initial connection of the jumpers in the input network. As I mentioned before, your 10 meter antenna, depending on its size and type, can look like almost any impedance to the converter at 9 MHz. The input network was designed to allow you to try to get maximum signal from the antenna to the converter.

Each of the suggested connections shown in Figure 6 can be tried to achieve best results. The heavy line represents a jumper. Start with jumping A to B as in Figure 6A. Then try some of the other variations to see which provides best results.

Both 6C and 6D include the use of variable capacitor C2. Adjusting C2 can make a major difference or no difference at all, depending on your antenna.

If you mount the converter in a plastic box, don't be surprised if several shortwave broadcast stations come in loud and clear with no antenna at all. In many areas they are so strong that they tend to ride through no matter what you do.

What You Can Hear

The 9 MHz shortwave band is listed as between 9.5 and 9.9 MHz, meaning that you will hear these stations on 29.5 to 29.9 MHz on your 10 meter rig. But don't be surprised to hear them at frequencies as low as 9.1 MHz. The band is pretty crowded and often stations will migrate just to find a clear spot—just as hams do!

When east-west propagation is down on the 9 MHz band, north-south propagation

Table 1. Marine Band Frequencies

(If only one frequency is listed both the ship and shore station or other ship use that same frequency.)

Ship	Shore	Use
8291		Emergency and Distress
8255	8779	Ship/Shore Calling/Reply
8201		Inland (River) Simplex
8213		Inland (River) Simplex
8725		Inland (River) Simplex
8737		Inland (River) Simplex
8294		Private company use
8297		Private company use
8113	8713	Ship-to-Shore Telephone
8128	8716	Ship-to-Shore Telephone
8198	8722	Ship-to-Shore Telephone
8204	8728	Ship-to-Shore Telephone
8207	8731	Ship-to-Shore Telephone
8216	8740	Ship-to-Shore Telephone
8219	8743	Ship-to-Shore Telephone
8222	8746	Ship-to-Shore Telephone
8225	8749	Ship-to-Shore Telephone
8234	8758	Ship-to-Shore Telephone
8237	8761	Ship-to-Shore Telephone
8264	8788	Ship-to-Shore Telephone
8267	8791	Ship-to-Shore Telephone
8270	8794	Ship-to-Shore Telephone
8279	8803	Ship-to-Shore Telephone
8282	8806	Ship-to-Shore Telephone
8285	8809	Ship-to-Shore Telephone

Table 2. Aircraft Band Frequencies

Frequency	Use or Area
8015	Alaska
8364	Search and Rescue
8822	Flight Test
8825	North Atlantic
8831	North Atlantic
8843	Central East Pacific
8846	Caribbean
8855	Alaska, South America
8861	South Atlantic
8864	North Atlantic
8867	South Pacific
8876	Alaska
8879	North Atlantic, Indian Ocean
8891	North Atlantic
8894	Africa
8897	East Asia
8903	Central West Pacific, Africa
8906	North Atlantic
8918	Middle East, Caribbean
8933	Long-Distance Control
8942	Southeast Asia
8951	Middle East

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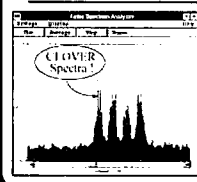
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usually picks up, so South American stations can predominate at certain times of the day. However, don't be surprised if you hear European stations when you least expect them. Many of them do not transmit from their home countries but use multi-megawatt relay stations in the Caribbean to carry their programs. In fact, the same transmitter, on slightly different frequencies, can be rented to one country's broadcast service for several hours a day and then to another country for a few more hours.

The 8.2 to 8.8 MHz range is a marine traffic band. Several U.S. shore stations provide weather broadcasts on voice at the hour or half hour; the only way to find them for your area is to tune around. Marine stations have two modes of operation: simplex and duplex. On simplex, both the shore station and the ship station use the same frequency. Duplex provides both a ship transmit frequency and a different shore station frequency.

Inter-ship communication (ship to ship) is usually carried on simplex, and telephone calls are carried on duplex. Table 1 provides a number of suggested frequencies to monitor.

The converter also covers the aircraft band of 8.8 to 9.1 MHz. Within this band

you may be able to hear trans-oceanic aircraft providing position reports to air control centers on both U.S. coasts. Listen for a burst of a few audio tones. This is SEL-CAL, or Selective Calling, which means that someone on the ground is dialing or calling a particular aircraft. Table 2 contains the international frequency assignments in this band. There is almost no QRM; you might be surprised at how well some of the aircraft stations propagate when they are transmitting from 35,000 feet.

Variations and Changes

Don't be hesitant to experiment. The converter is not sensitive to changes and has no critical elements. For example, if you use a 13 MHz crystal instead of the 20 MHz unit shown, and take a few turns off the large winding of T1, you can cover the 15 MHz shortwave broadcast band. Changing the crystal to 13 MHz means that your converter output is $13 + 15 = 28$ MHz, so the new crystal provides a different shortwave band.

Try the converter! With just one evening's work you can enjoy your 10-meter rig in the car when the band is closed and you would like to hear something other than a 30-year-old pop tune.

Parts List

(All parts numbers given are Radio Shack, unless otherwise noted.)

R1	30k	1/4 watt	271-040	
R2	3.3k	1/4 watt	271-028	
R3	47k	1/4 watt	271-042	
R4	100 ohms	1/4 watt	271-012	
C1	4.7 pF	Disk—50W VDC or more	272-120	
C2	95-420 pF	Trimmer cap	272-1336	
C3	4.7 pF	Disk—50W VDC or more	272-120	
C4	001 MFD	Disk—50W VDC or more	272-131	
C5	4.7 pF	Disk—50W VDC or more	272-120 (see text)	
C6	47 pF	Disk—50W VDC or more	272-121	
C7	0.01 MFD	Disk—50W VDC or more	272-131	
C8	100 pF	Disk—50W VDC or more	272-123	
C9	0.01 MFD	Disk—50W VDC or more	272-131	
C9	10 MFD	Electrolytic—35W VDC	272-1013	
Q1	MPF102	Field effect transistor	276-2062	
Q2	MPF102	Field effect transistor	276-2062	
T1	100 µH	RF choke 273-102 (modified—see text)		
T2	100 µH	RF choke 273-102 (modified—see text)		
L1	100 µH	RF choke 273-102		
SO 1	239 type	UHF socket	278-201	
SO 2	239 type	UHF socket	278-201	

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*These crystals are available by mail order from several sources at less than \$3 each. One source is All Electronics Corporation in Van Nuys, California. Their catalog is available by calling (800) 826-5432. The crystal is listed in their catalog as CRY-2018, for \$1.25. Their minimum order is \$10, and you should be able to get many of the parts above for this minimum.

Printed circuit boards are available for \$3.50 plus \$1.50 S&H from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

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Hierarchical Addressing

This month we'll take a look at a part of packet operation that is both very simple and (apparently, based on mail received here at N1EWO) confusing. It takes just a little understanding of this scheme to make it crystal-clear.

What Is Hierarchical Addressing?

Hierarchical addressing is a scheme which allows packet traffic to be routed easily by the stations that comprise the amateur packet network. It eliminates the need for each station in the chain to know exactly where to send a particular message or bulletin. To understand how it works, let's take a look at the term itself.

Working backwards, we have "addressing." The idea of addressing is easy for all of us to understand. Addressing a packet message is just like addressing a letter. It tells the delivery system—packet network or post office—where to route the addressed item. Then there's "hierarchical," a

word that many people have a tough time pronouncing. Say "hi-ur-ark-ik-ul." What is meant by this word is that the addressing scheme has a hierarchy from very specific—a particular ham—

to very general—a continent. These elements are arranged in a "hierarchy," hence the name.

This is really no different from our previous example of an ordinary letter. Let's compare the two:

To send me mail, you address your envelope:

Jeffrey Sloman
P.O. Box 636
Franklin IN 46131

To send me a packet message, you address it:

N1EWO@N0ARY.#NOCAL.CA.US
A.NA

There are clear parallels between the two schemes. Ignoring for the moment the ZIP code, which actually uses its own hierarchical scheme, let's compare elements directly. The most specific information in each case is the recipient—me, Jeffrey Sloman or N1EWO. This says exactly who should receive the message. It is, therefore, at the very top of the hierar-

formation to the delivery system. However, in order for the system to work, it must already know *something* about what the address means. If it did not, you would have to provide detailed instructions (e.g.: "go three blocks on Main Street and turn left—it's the green house on the right," or a list of every PBBS between you and your recipient) that would be impossible to handle. So the point of the address is to let the delivery system know, in

***"Let me point out something interesting here:
When you address a message you are providing certain
information to the delivery system. However, in order for
the system to work, it must already know something
about what the address means."***

chy. If this were the only information the address provided, a huge file listing the addresses of every possible recipient would have to be kept by the post office—(an impractical situation, since names are not unique)—and by the PBBSs (Packet Bulletin Board Systems) that make up the forwarding network—(not as difficult, but still hard to maintain).

Let me point out something interesting here: When you address a message you are providing certain in-

formation about the desired destination that it can use to get your message there.

The next, less specific, element is P.O. Box 636 or N0ARY. This is the place that the mail will be delivered for me to retrieve (note that a street address serves the same purpose). This is followed by a Franklin and #NOCAL. Notice that there is a "#" in front of "NOCAL." This is because it is an optional, regional destination. The "N"

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lets the PBBS know how to interpret this element. Many states have regional addresses which help speed forwarding. Your area probably has at least a couple of divisions that you can use to direct traffic. You can ask a local user, write a message to the PBBS sysop (SYSTEM OPERATOR), or just watch traffic go by to find out how your area works.

The next element is IN or CA. These are exactly alike—they name the state to which the traffic will be sent. The packet address has additional information: USA—for United States of America, of course—and NA for North America. This information is assumed by the post office, so it is left off.

Now, while a packet address is written from top to bottom, it is used exactly the other way. By sending a message to the station responsible for the next element, (starting from the least specific), any particular station needs only to know about its own area in detail, (and only generally about other areas). In the example of my packet address, let's pretend we are sending me a message from France. We log on to a local PBBS and compose a message. We address it using the full hierarchical address. The local PBBS sees the very bottom of the address—NA. We are in Europe, so the PBBS knows that this message isn't even on the right continent yet!

The French PBBS need not be concerned with any other address information—it will just squirt the message across the HF link to the North American PBBS which it knows is responsible for handling message bound for North America. Now the North American PBBS, located in Canada, receives the message. It looks at the next element in the address and sees that it is USA. No problem—it sends the message to a PBBS in Boston which it uses to forward US messages. This PBBS—you guessed it—

a message makes is completely dependent upon the network resources available at the time. I just wanted you to get a feel for the utility of hierarchical addresses.

Practical Addressing

So now that you have a feel for what hierarchical addressing is, how do you use it? The fact of the matter is, you are probably better off just using an abbreviated address. That is, you should use just the recipient and PBBS:

"Now you can venture out into the world of packet radio, armed with your new knowledge and ready to send messages to anyone, properly addressed."

looks at the next element, CA. The message gets forwarded to the next PBBS in the chain because it is on the path to California. This process continues until the message arrives at its destination.

Please note that the example above may not reflect reality. Depending upon the availability of links, the French PBBS might have forwarded directly to California. How many hops

N1EWO@N0ARY

This is because the rest of the address is most likely already stored in the PBBSs database, and if you make a mistake, even a small one, in writing out the whole address, your mail will sit until the sysop can straighten it out. If you are confident of your ability to not screw up, you can include the whole address. If you have regular correspondence with a user of a re-

mote PBBS, you need only use the whole address once and the PBBS will remember. If you use a truncated address, and the PBBS cannot fill in the rest, you will probably get mail from the sysop asking for the information.

So, while I can't say you now know everything about hierarchical addressing, you should know enough to feel comfortable with it. Now you can venture out into the world of packet radio, armed with your new knowledge and ready to send messages to anyone, properly addressed.

Survey News

By now, I had hoped to have the survey results compiled for publication. Unfortunately, the whirlwind of activity here at N1EWO has prevented me from doing it. I will, however, have the data available for the next issue. Thanks to all who responded. 73 de N1EWO.

How to Reach Me

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Packet (No business, please; I cannot respond to messages doing business):

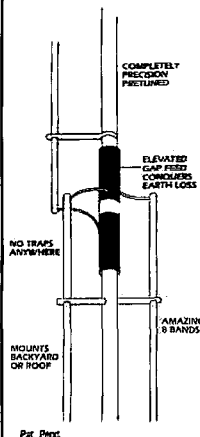
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Selecting Variable Capacitors, Part I

Variable capacitors are a regular part of amateur radio circuits. While the new generation of hams might see fewer variable capacitors in their modern equipment (phase-locked-loop synthesizers and solid-state RF power amplifiers don't use them like the "old stuff" did), they are still found extensively in antenna tuners, preselectors, and in many—perhaps most—home-brew rigs. Selecting the right variable capacitor requires a little insight into the different types of variable capacitors available. Also, you might be interested in where these "antiquities" can be purchased.

What Are Variable Capacitors?

Capacitors are formed by placing two conductors opposite each other, separated by an insulating dielectric. Different types of dielectrics are used in variable capacitors: vacuum, air,

mica, and poly film are the most common. The capacitance is inversely proportional to the spacing between the metal plates of the capacitor (moving them closer together raises capacitance). In transmitters and antenna tuning units, there must be a trade-off between the wide spacing necessary to increase the working voltage and the narrow spacing required to increase capacitance. The capacitance is directly proportional to the area of the metal plates facing each other (whether by size of the plates or by the number of plates) and the dielectric constant of the insulator between the plates.

Making a capacitor "variable" can be accomplished in several ways: changing the spacing between plates (in compression capacitors), or changing the proportion of total plate area "shading" each other (in most rotary variable and piston capacitors). Compression capacitors are typically used for "trimmer" or "padder" applications. A trimmer capacitor is placed in parallel with the main tuning capacitor

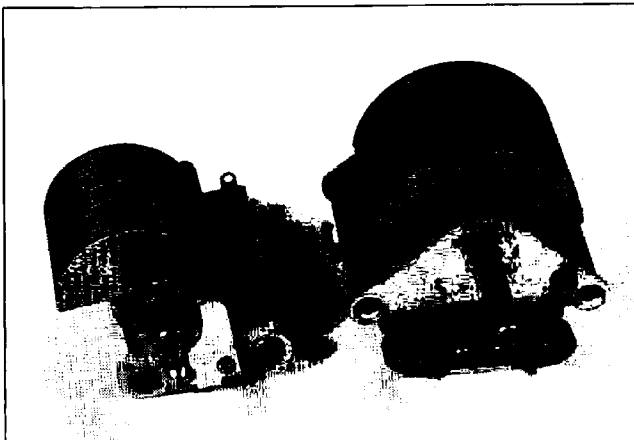


Photo A. Two forms of variable capacitor: straight line frequency (left), and straight line capacitance (right).

itor in an LC resonant tank circuit, while a padder is placed in series with the main tuning capacitor.

Another way to classify capacitors is according to the manner of the capacitance change when the tuning shaft changes. Photo A shows the two different forms: a straight line frequency capacitor on the left; a straight line capacitance form on the right. A straight line capacitance capacitor has a constant capacitance change per degree of shaft rotation

($\Delta C/\text{degree}$). For example, suppose a capacitor is designed to provide a capacitance range of 7.7 to 100 pF, or a range of 92.3 pF over 180 degrees of shaft rotation. That capacitor will show 0.513 pF/deg all across the range. A straight line frequency capacitor uses shaped plates to account for the fact that the resonant frequency of an LC tank circuit changes as the square root of the capacitance changes. These capacitors have a constant frequency change per degree of shaft rotation.

The type of capacitor selected can have a profound effect on the look of a calibrated dial. A straight line capacitance device will cause the frequency units to scrunch up on one end of the dial (you've seen that effect on some AM band radios), while a straight line frequency device will show equal frequency change for every linear dial division. Radio receiver LOs and transmitter VFOs will usually want a straight line frequency type, while certain instruments (such as an impedance bridge) might require a straight line capacitance type.

Two different types of air variable capacitor construction are shown in Photo B. The capacitor in Photo B-1 uses two end plates (one front and one rear), while the capacitor in Photo B-2 uses a single end plate. "Conventional wisdom" suggests that the dual end-plate units offer better mechanical stability so they are better for VFO/LO applications. But in reality, there seems to be a trade-off. After building a lot of VFOs and LOs during the past 30+ years, I can't see the advantage, especially when you consider other sources of drift and shift appear far more severe in those circuits.

Note that the capacitor shown in Photo B-2 uses a ceramic end plate. Others will use a metal end plate, which also serves to ground the capacitor when it is directly mounted to a chassis. The ceramic type end plate makes it easier to "float" the capacitor. There are two ways to do this trick. First, cut a hole in the metal panel wider than the 3/8" threaded

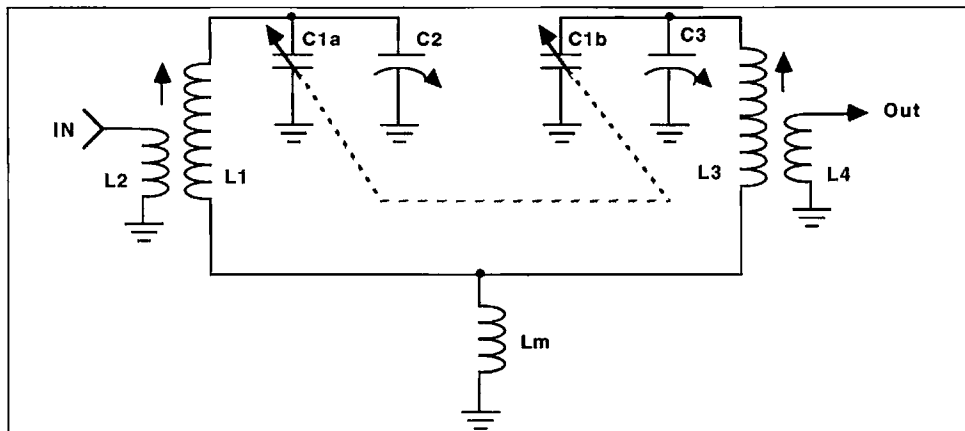


Figure 1. Doubly tuned RF "front-end" selector.

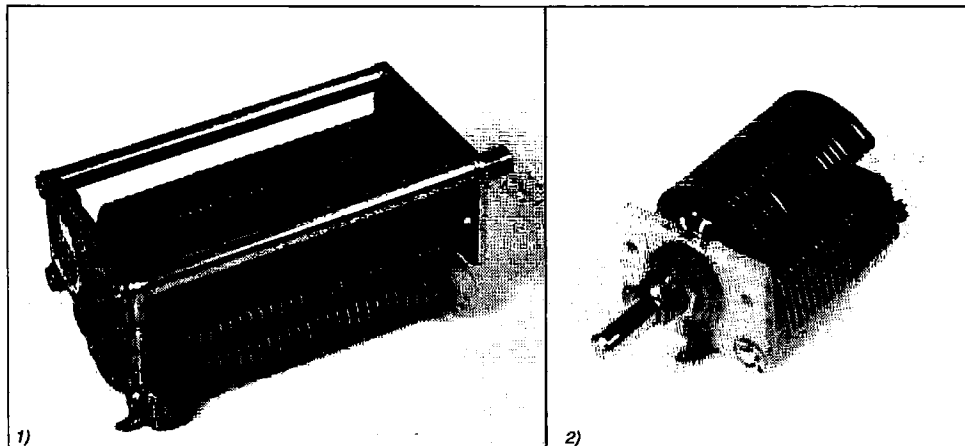


Photo B. 1) Two-end plate variable; 2) single-end plate variable.

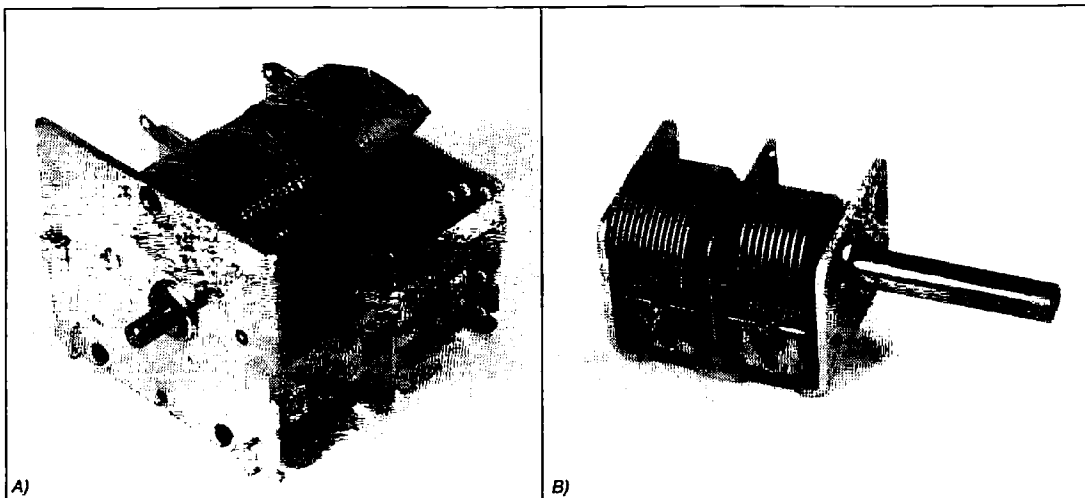


Photo C. Two-section variable capacitors: A) both sections the same; B) front section smaller to tune LO (used in superhet radio receivers).

bushing, and a 3/8" hole in an insulator piece of material. The capacitor is mounted to the insulator, and the insulator is mounted to the panel. The second way is to cut the hole larger than 3/8", but also drill two mounting holes on either side of the shaft hole and use the holes in the ceramic end plate to hold small screws.

Photo C shows a pair of dual variable capacitors. The capacitor in

Photo C-1 has two sections that each have the same capacitance range. For "broadcast variables," the normal capacitance range is 10 to 365 pF, although 10-380 pF, 10-300 pF, 9-140 pF, 10-440 pF and 12-500 pF capacitors are available. The 140 pF are typically used in transistor portable radios, and the other values are found in radios from other countries. For most broadcast receiver variables


used in this country, if the two sections are identical, the range is 10-365 pF.

One application of dual capacitors is to tune two ends of a double-tuned RF input LC tank circuit (Figure 1). This circuit consists of two LC resonant tank circuits (L1/C1A/C2 and L3/C1B/C3) that are coupled together through a small mutual inductance Lm. Information on selecting the val-

ue of the mutual inductance can be found in nearly any edition of the ARRL *Radio Amateur's Handbook* (or *Handbook for Radio Amateurs* in later editions). The RF signal is coupled into the circuit through a low impedance link (L2), and out of the tank circuit by another low-Z link (L4).

Getting the two halves of the double-tuned tank circuit to "track" to the same frequency is done by making use of the variable tuning feature of inductors L1 and L3, and the trimmer capacitors (C2 and C3). In most cases, the inductors are adjusted for peak signal output at the low-end of the band, and the trimmers are adjusted at the high end of the band.

Another application of the dual variable is to simultaneously tune both the RF amplifier input and the local oscillator in a superheterodyne radio receiver. The frequencies of these circuits differ by the amount



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RANDOM OUTPUT

Continued from page 96

of being a first QSO, this one on the 10 meter Novice phone portion. It was surprisingly similar to my own first QSO. The young newcomer was at a friend's house, "borrowing" the station for his first QSO. He was quite nervous, and admitted to being so. I told him about my first QSO, which helped to break the ice. Boy, first QSOs are sure easier on SSB! I explained to him that he didn't have to give our call signs before and after every transmission, that the goal was to be as conversational as simple communication will allow (advice I give to every new ham I find myself in contact with). We ended up having a nice little QSO, with his friend interjecting comments now and then. I felt I was sort of "paying back" that ham in Dallas, and my high school radio club buddies.

A few days later, I received a QSL card in the mail, thanking me for being a first QSO. I've been a ham for almost 20 years, and I've got a box full of QSL cards. I keep a half dozen or so at my operating position, to remind me of particularly pleasant contacts. I keep the "first QSO" card at the top of the pile. It reminds me of some things it would do us all well to remember now and then.

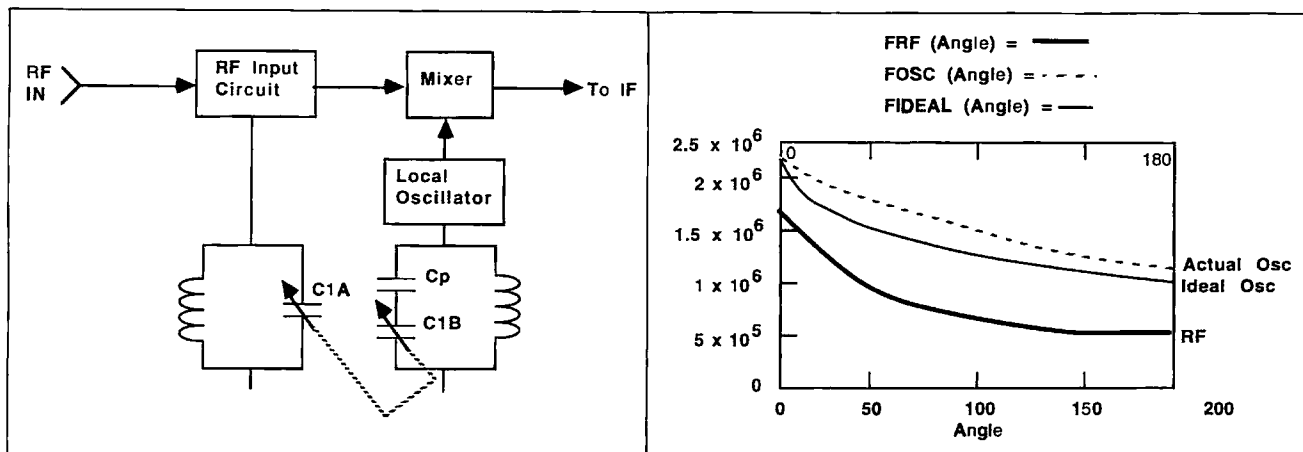


Figure 2. A) Block diagram of superheterodyne front-end showing use of the padder capacitor; B) MathCAD tuning curve for an AM BCB case using a padder capacitor.

of the IF frequency. For example, in a 75/80 meter receiver that uses a 455 kHz IF amplifier, the RF circuit will tune 3,500 to 4,000 kHz, while the local oscillator tunes from 3,955 to 4,455 kHz. The frequency ratio of the RF is 1.143:1, suggesting a required capacitance ratio of 1.143², or 1.306. The LO, on the other hand, has a frequency ratio of 1.126:1, requiring a capacitance ratio of 1.126², or 1.268:1. One method for achieving improved tracking between the RF

and LO is to use a padder capacitor (Cp) in series with the section of the main tuning variable that tunes the LO (C1B in Figure 2A).

There is a little bitty problem with using a padder capacitor to achieve tracking, even though it was once very popular. Figure 2B shows a MathCAD plot of the RF frequency, ideal oscillator frequency, and actual oscillator frequency for an AM BCB case (225 μ H inductor, and 2X 365 pF capacitor). Note the large separ-

ture between the ideal and actual local oscillator frequency curve. This problem is fixed by using a specially designed variable capacitor, like Photo C-2, in which the front section is smaller (and has slightly differently shaped plates in some models). The front section is designed to tune the LO frequency range, while the rear section tunes the RF frequency range. Popular combinations include 8.5-105 pF/15-480 pF and 10-140 pF/12-420 pF.

Next Month . . .

In the final installment of this two-part series we will take a look at transmitting variable capacitors, the differential variable, the split-stator variable and some of the circuits in which these are used. Another topic in Part II will be calculating the trimmer values and inductance values needed for tuning a specified frequency range (like a ham band). We will also look at some sources of supply for variables.

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One of the most formidable challenges for the amateur radio satellite chaser is to make a successful voice or packet contact with a space shuttle. Making such a contact will require a level of operating skill, patience and equipment performance not needed for regular hamsat activity.

The amateur radio equipment carried on the shuttle is part of SAREX, the Shuttle Amateur Radio Experiment. Various equipment configurations have been in use since 1983 when Owen Garriott went to space in the *Columbia* on mission STS-9. He operated voice on 2 meters. Many SAREX missions have followed.

STS-56 flew in April 1993, carrying equipment for packet, voice, SSTV and FSTV reception. The mission was a success, with a full schedule of school contacts, FSTV tests, some SSTV activity and general QSOs.

In May, STS-55 carried packet and voice gear, known as configuration "C," in conjunction with the German SAFEX (Shuttle AmateurFunk Experiment) equipment for 70cm FM operation. Comparisons were made between the window-mounted SAREX antenna and the quarter-wave whip attached to the outside of the German spacelab. The whip performed 12 dB better than the window antenna.

Three more SAREX flights are planned this year, including STS-57 in

June, STS-58 in August and STS-60 in November. They will use packet and voice.

The shuttle is typically in a low orbit between 120 and 310 miles, with an inclination between 28 and 57 degrees. This means short passes, a variable orbital decay rate and low elevation angles for antennas. There are also large Doppler shifts of the signal frequencies.

"Such obstacles cause some amateurs to give up while inspiring others to try every means available to make a contact. Before attempting a shuttle contact be sure to observe the rules of the game."

The ham-astronauts cannot operate on every pass for general contacts. The work timeline and scheduled contacts with schools and families take precedence. The packet equipment, if on board, is usually active for those passes when the astronauts plan no other ham activity. But even the packet has been shut down when the antenna window is required for photography and other experiments.

The SAREX antenna is mounted in one of the cabin windows and can be shadowed by the spacecraft. Signals can be difficult to copy for as much as half the pass. This affects uplink signals as well.

SAREX Procedures

Such obstacles cause some amateurs to give up while inspiring others to try every means available to make a contact. Before attempting a shuttle contact be sure to observe the rules of the game.

First, *never* transmit on 145.55 MHz; second, *never* call the shuttle if transmissions from the spacecraft are not on 145.55 MHz. Many stations have been heard calling on 145.55 MHz. Although the SAREX Motorola HT is capable of reception on 145.55 MHz, experience has shown that split-frequency operation is necessary. Voice uplinks for all stations except Europe start at 144.91 MHz and go to

144.99 MHz in 20 kHz increments. Except in emergencies, the SAREX HT will *never* be set to receive on 145.55 MHz.

For packet activity, the uplink is 144.49 MHz and the downlink is 145.55 MHz. When sending connect requests, call W5RRR-1. The specially modified Heathkit TNC uses the call-sign of the Johnson Space Center Amateur Radio Club with a "-1" SSID (sub-station identifier) at the end. The packet operation does not currently use a standard 600 kHz split, so be sure to use a radio capable of the odd split.

During voice activity, if the ham-astronaut appears to be engaged in a

scheduled contact on 145.55 MHz *wait* until the QSO is complete. It's better to get a QSL for a "heard" contact than to interfere with a school or family pass. Special QSL cards that differentiate between SWL and QSO activity are no longer printed.

Making Contact

Using the rules above as a starting point, there are many ways to increase your chances for a good contact, or at least hearing SAREX activity to qualify for a SWL QSL.

If you are using a directional antenna you need to know where to aim. A computer with a good tracking program that can handle orbital decay data is the best approach. Several programs are available through bulletin boards for free or as shareware. Some of the best programs are sold by AMSAT, the Radio Amateur Satellite Corporation (850 Silgo Ave., Silver Spring MD 20910; telephone: 301-589-6062).

Accurate orbital data is needed to give the program information to locate the shuttle and determine antenna pointing angles for your location. This data is commonly referred to as element sets. Due to the high and variable decay rate of the shuttle's low orbit, current element sets are a necessity. They can be found on packet radio bulletin boards, CompuServe, the Dallas Remote Imaging BBS (214-394-7438), the AMSAT BBS (201-261-2780), SPACELINK BBS at (205-895-0028) or from WA3NAN at the Goddard Spaceflight Center. WA3NAN operates on several HF frequencies during missions including 3860, 7185, 14285, 21395 and 28650 kHz. Most flights require accurate tracking data not more than two days old for accurate antenna pointing. If an omnidirectional antenna is used it is still a good

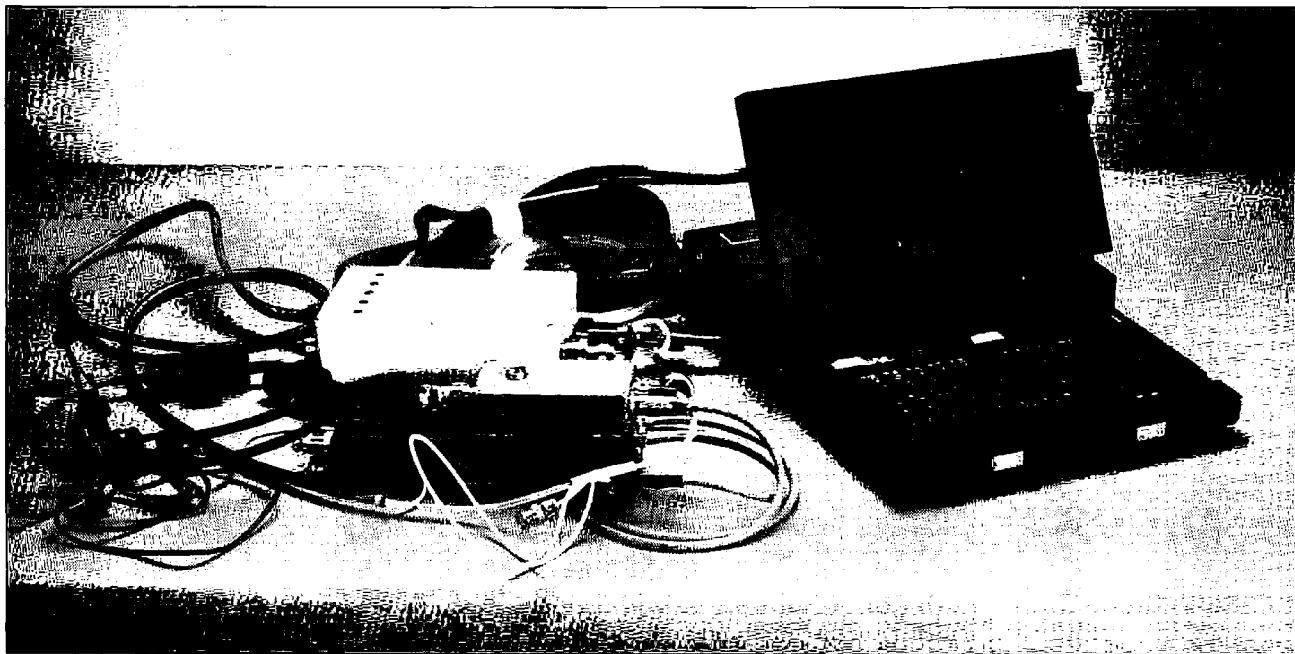


Photo A. Typical configuration "C" for SAREX voice and packet. (NASA photo.)

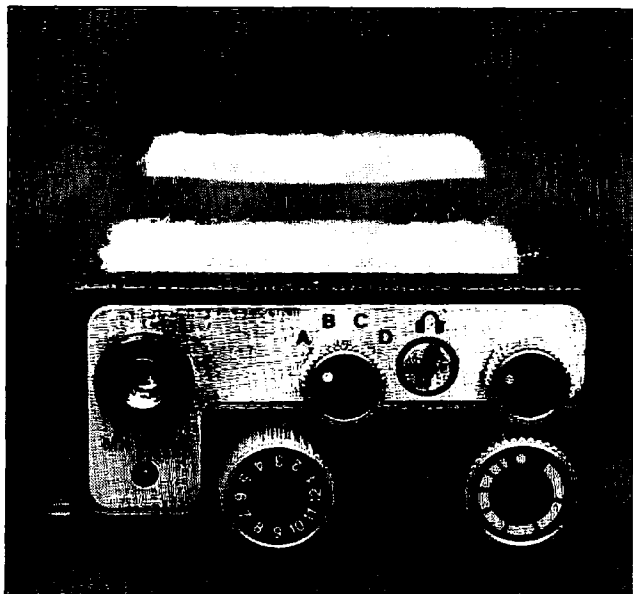


Photo B. End view of the Motorola SAREX HT shows channel selection knobs and other controls. (NASA photo.)

idea to know where the shuttle is located in the sky.

If you are aiming the antenna with an autotracking computer system, set the computer time exactly or slightly ahead, depending on how often the system updates the antenna position. For those with manual control, lead the shuttle by 30 seconds to a minute

to allow time for typing or calling as the spacecraft travels through the center of your beam pattern. Keep this up for the duration of the pass.

Be ready for voice or packet operation. The passes are short, usually about eight to 12 minutes. Antennas should be pre-aligned, receivers set to 145.55 MHz and transmitters set for

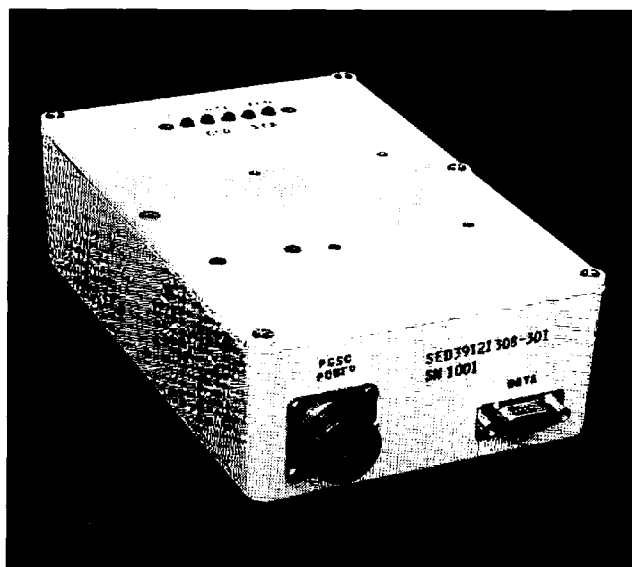


Photo C. Repackaged Heathkit TNC for SAREX operation. (NASA photo.)

144.49 (packet) or 144.95 (voice).

Additional frequency correction can be dialed in for Doppler shift. When the shuttle is approaching on a high-elevation pass, the received signal will be a few kHz high, so listen around 145.553 MHz. If possible, the transmitter should be set a few kHz low. This will center your signal in the receiver

on board the shuttle. When the shuttle is at its closest approach, there is no apparent Doppler shift so set both frequencies as listed. As the shuttle heads away, transmit a few kHz high and receive a few kHz low.

For packet operation set RETRIES=0. Many calls may be necessary to get through, and a timeout is

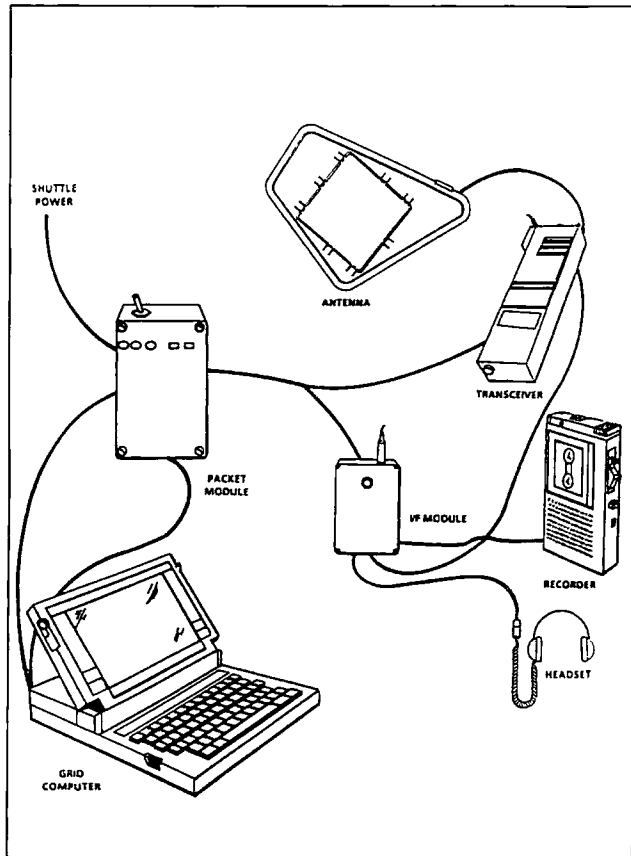
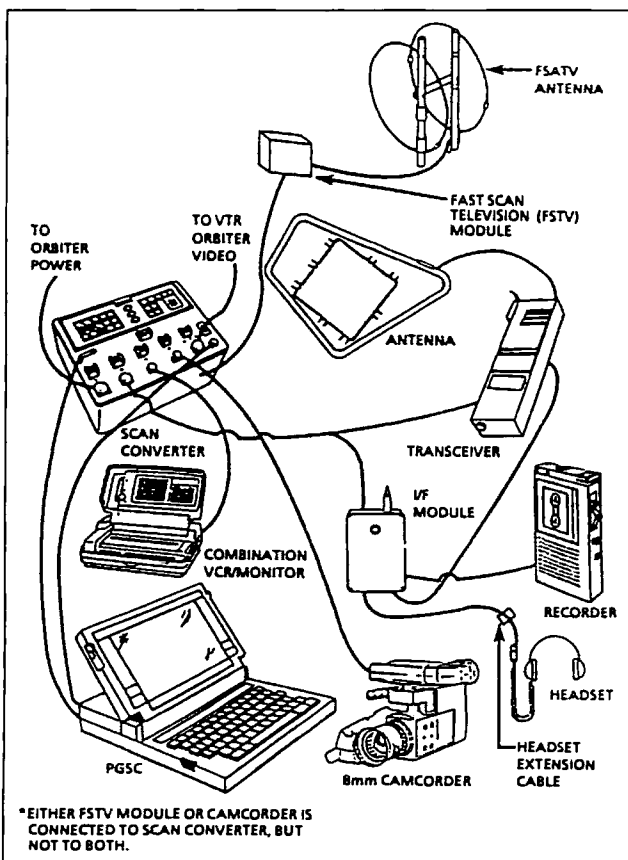


Figure 1. Pictorial of configuration "C." (NASA drawing.)



*EITHER FSTV MODULE OR CAMCORDER IS CONNECTED TO SCAN CONVERTER, BUT NOT TO BOTH.

Figure 2. Pictorial of SAREX system used on STS-56 for voice, packet, SSTV and FSTV reception. (NASA drawing.)

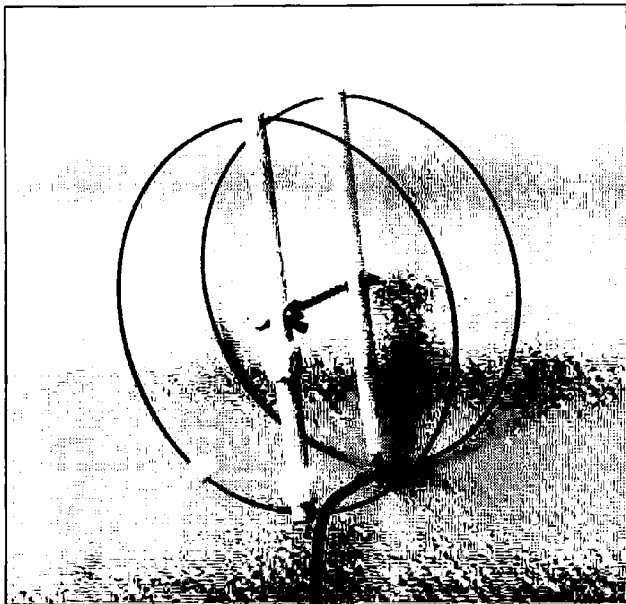


Photo D. Prototype of SAREX 70cm loop yagi for FSTV reception.

inconvenient. Other parameters may be adjusted for faster and more aggressive operation. Check the TNC (Terminal Node Controller) manual and experiment. If the SAREX TNC hears your call it will respond. Your system will register the connect and hopefully receive a QSO number. Your system

will then "ACK" back to the shuttle. The SAREX TNC will register the "ACK" and send a disconnect packet. Your system will respond and show "DISCONNECTED." If all goes well, your call will show up in the "QSL" list with a QSO number. If the complete contact was not successful, your call will be in

the "QRZ" or heard list. The SAREX TNC can capture and hold 650 stations in the "QSL" list, but only a few dozen in the "QRZ" list. It is up to the laptop computer on the shuttle to collect "QRZ" list data. Be sure to capture the data in your own machine for confirmation later since there is no guarantee that the SAREX laptop is on and collecting data. Beacon packets with the latest lists are sent every two minutes by the SAREX TNC.

For a voice pass use 144.95 MHz as the default uplink. Most operations on STS-56 and STS-55 earlier this year used this frequency. It is 600 kHz below the downlink on 145.55 MHz and can be used on all 2 meter FM rigs with standard repeater offset capability. Once again Doppler correction helps. If other stations are making contacts with the shuttle using the alternate uplinks (145.91 MHz, etc.)—try them. If the QRM on 144.95 MHz is fierce, the ham-astronaut will likely listen for signals on one of the other uplinks.

If you have an amplifier, use it. For packet, make one good contact and quit. The same goes for voice. Hundreds of stations are calling and multiple contacts or attempted rag-chewing won't help. A few hams have been known to make as many packet connects as possible for several passes. This inconsiderate activity makes it hard or impossible for everyone else.

It's a good idea to monitor as many

passes as possible, even after a successful QSO, just to practice antenna aiming and frequency tuning. The next shuttle flight might not be as easy.

If no activity is heard on 145.55 MHz, tune around. Scheduled contacts with schools or home may be taking place on unlisted downlinks. Early in a mission most passes are set aside for schools. Just listening to the astronauts' answers to questions from the school children is exciting. These kids may be future scientists, hams or even astronauts who got their first inspiration from the direct interactive conversation with an astronaut via SAREX. Don't even try to call if the downlink is not on 145.55 MHz. The SAREX Motorola HT uses much different uplink frequencies for these downlinks. The radio has 48 "channels" defining specific uplink/downlink pairs.

When a shuttle mission goes for an extra day due to bad weather at the primary landing site, or to allow more scientific studies, additional ham activity is common. The scheduled contacts are usually done and the ham-astronauts may have time for just "playing with the radio." A lot of good contacts have been made this way. The "big-guns" have made their contacts and are off chasing other DX on HF. Stations with less power or smaller antennas can usually get through with these conditions. Mobile stations and even those with HTs have had success. It's worth a try.

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RTTY LOOP

Number 17 on your Feedback card

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

With all the traditional hoops and hoopla, I am happy to inform all of you that this column marks the beginning of the seventeenth year of "RTTY Loop." Believe me, it would not be possible, it would not even be thinkable, without all of your support.

In that regard, I appreciate the recent messages from Richard J. Molby and Tom Vicinanza (both via CompuServe), with their words of encouragement. Tom is looking for hands-on help in the Orlando area to help get his TTY machine online. Any takers?

Another CompuServe junkie, George F. Franklin W0AV, is looking for software to interface a TRS-80 Model 4 with a KAM TNC. George is one of a number of us who upgraded his business computer and is looking for a use for this otherwise-good orphan. Well, other than a modem communications package, I have no specific suggestions. Again, is anyone out there using such a combination?

That's the thing with RTTY—folks are always finding new ways to use old devices. For instance, Roger Owen WD8DJR of Eaton, Ohio, says that at one time he had an AEA PK-64 on RTTY, without much success. A short while ago, though, he found a used AEA CP-1 Computer Patch for a very good price and made the purchase.

"The CP-1 seems to be a very good RTTY modem, and I interface it with my Commodore 64 computer, which the CP-1 was designed for. So I have made a few RTTY contacts, but I can't say that I find much activity on any band.

"Twenty meters seems to be the most-used RTTY band but, of course, it fades out when I have the chance to

Amateur Radio Teletype

get on the air. (Isn't that always the case, no matter what mode?)

"The main objective in writing to you is that for those of us who can't afford a super whiz bang megabyte computer, with all the bells and whistles, and a RTTY unit with even more bells and whistles, I find the AEA CP-1 and Commodore 64 hard to beat. The problem I find, though, is that the CP-1 seems to be as scarce as hen's teeth.

"I use the CP-1 with a Kenwood TS-530S, and it seems to do the job. When I tried RTTY before, I found that the 530 did not have good filtering, so it was difficult to copy, mark, and space signals on RTTY. With the CP-1, the filtering is already built in. Hot dog, I'm now on RTTY!"

Roger's success should be a lesson for all of us. You don't need the latest and greatest to get onto RTTY. I know I have been saying this for quite some time, but it's a message worth repeating.

Some solve problems, others pose them. Henry Fales, Jr., of Orleans, Massachusetts, writes that he has "a friend who is a confirmed satellite QSOer. This guy has very elaborate radio equipment but is using a C-64 for tracking and decoding. Until now, the bit rate has not exceeded 1200 baud, so he has been able to get away with a C-64. Soon, however, things are going to change. The new packet satellites will operate at 9600 baud, and my friend will have to change computers.

"This person will not use a computer for anything other than amateur radio. Therefore, I would like the changeover to be as inexpensive as possible. Is it possible that a Commodore 128 could read and write ASCII at 9600 baud? If this were possible, I believe that he might be able to continue to use his disk drive and printer.

"I feel certain that an Amiga A500 could do it, but I hesitate to recommend a computer which is now an orphan. Please roll this around and let me know what you think. Perhaps there are readers of the column who are facing the same choice."

This is a problem with many low-end computers, Henry. The Radio Shack Color Computer is in much the same boat, with a significant upper limit on the speed of data communication. Personally, I would think you should be able to get an inexpensive PC compatible to serve, particularly if nothing too demanding is required of the thing. A used XT-style machine shouldn't set you back more than a couple hundred dollars, and might just include a hard drive, software, and other goodies. Shop around, and don't be surprised at what might be sitting in someone's basement.

Finally, here's a letter from Steven Petrecz N5WKL of Bossier City, Louisiana, asking a simple question that has a complex answer. Steven says that he is interested in starting to monitor RTTY on HF, and transmitting on VHF. He is in the process of building the FSK demodulators that are described in the Tab Books' publication 1001 Electronic Circuits, and he wants to build a video display, or "glass teletype," such as the HAL RVD-1005. He says that he does not want to use a computer as he feels he cannot justify such a purchase at this time.

Steven is looking for articles, books, and sources for parts for such an endeavor. No novice to construction, his ultimate desire is to build a basic solid-state RTTY station without having to resort to a computer.

At this time, this month, a complete answer to your question is really beyond the scope of this column. Over the past several years, several such terminals have been described in the pages of 73 Magazine. A search through the 73 index will show some built from discrete chips, and others from integrated circuits. There really are many ways to

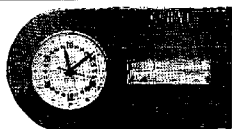
skin this cat. The reason more of these circuits are not published now is that simple, cheap, and readily available used computers work better. However, that is no reason to abandon the older technology, if that is your preference.

So, if there is some demand for it, I'll see what I can do about abstracting or serializing a project like this. I hesitate to do it if there is only very limited interest, but I will gladly dive in if some of you let me know that you would like the information.

Remember that readers of "RTTY Loop" continue to have access to the vast collections of PC-compatible amateur radio programs. RTTY and amateur radio programs are in collections #1, #2, and #4. Collection #3 is a bunch of archiving and utility programs for both DOS and Windows. Each collection will fit on a 1.44 Mb, 3.5" disk. One or two programs may be lost trying to cram them onto a 1.2 Mb 5" disk, and you will need to send a whole bunch of low density disks, if that is your system requirement. Anyway, for any or all of the collection, send me sufficient media, a return mailer with sufficient postage affixed, and \$2 in US funds for each disk to be filled, to the above address. I am trying to turn these around within a few days so, if you have sent me a disk or disks and haven't heard in a reasonable period of time, drop me a note or an E-mail message to make sure I received the original package.

We'll try to get a schematic in next month for those of you with solder to spare and a hankering to strip some wire. One thing about this column, folks, is that you never really know in what direction we will go. Be sure to share your thoughts with me via mail at the above address, CompuServe (ppn75036,2501), Delphi (username MarcWA3AJR), or America On-line (screen name MarcWA3AJR). During our seventeenth year I will continue to address your questions and concerns about digital communication, from RTTY to computers, here in 73's "RTTY Loop."

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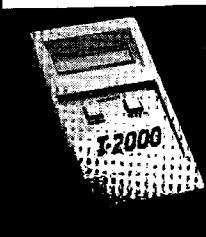
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HOMING IN

Number 18 on your Feedback card

Joe Moell P.E. KØOV
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Fullerton CA 92633

A "Swiss Army" Foxbox

Hams who enjoy hidden transmitter hunting are some of the most creative people I know. Not only do they delight in finding devilish hiding places for "T-hunts" or "foxhunts," as these contests are called, but they are also creative in choosing and using radio direction finding (RDF) equipment.

"Homing In" regularly features hams who are pioneering new RDF devices and techniques. This month, the spotlight is on Marty Mitchell N6ZAV and Byron Garbrandt KD6BCH. If it's the second Tuesday or first Thursday evening of the month, Marty and Byron will probably be competing in the informal 2 meter "progressive" hunts in Orange County, California.

One participant starts a progressive hunt by activating his hidden T at 7:30 p.m. The first person to find it immediately sets out in search of another hiding spot and puts T #2 on the air about the time the last hunter finds T #1. Now everyone else, including hider #1, looks for T #2. The first finder of #2 goes out to hide T #3, and so on. The hunt continues until about 11 p.m., or whenever everyone decides to quit and head for a coffee shop.

Progressive hunts, sometimes called "leapfrog" hunts, are great practice for rapidly tracking down jammers and QRN sources. In order to participate you need your own RDF gear, plus a rig to hide when it's your turn. Since more than one fox may be active at a time, each should transmit regularly for only a few seconds, then be silent.

Marty and Byron set out to design an easy-to-use tone source and transmission cypher. Marty started with the versatile 8-bit HCMOS Motorola MC68HC705C8 microcontroller IC, which has on-board 8K ROM, 304-byte RAM, and I/O ports. He added ICs for RS-232 interface, tone decoding, and audio switching. Byron began writing the software.

Before long they had created a device that they decided to market. It is more than just a foxbox. It's a multi-function radio controller—hence its name.

The RaCon 6805

All you need to be the quarry for your club's next foxhunt is the RaCon 6805, a transceiver (mobile or handheld) for the hunt frequency, and a command transceiver (Photo A). You trigger RaCon to start transmitting or change its transmission sequence with dual-tone (DTMF) digits from the command radio's keypad. An intermittent-signal fox can be commanded on the hunt frequency by connecting RaCon's control input to the external

Radio Direction Finding

speaker/earphone jack on the hidden T.

Your callsign is permanently programmed into the microcontroller's ROM, as are nine transmission modes. They include three distinctive tone patterns and six on/off sequences, with transmit times from five seconds to four minutes. Dead times range from five seconds to one minute.

Preferences for foxhunt transmission sequences vary greatly across the country. For instance, in Southern California 15 to 30 seconds on, followed by an equal off period, is a popular mode. In some Midwestern and Great Plains states there aren't any big hills to reflect 2 meter signals or woods to conceal transmitters. To make the hunts more of a challenge there, rules often allow several minutes between fox transmissions.

To prepare for national distribution, Byron upgraded the firmware to accommodate these various local customs. In version 1.01, transmission mode #2 is user-programmable. With commands from your DTMF pad you can make its key-down periods as long or short as you want, with dead-time breaks from 0 to 15 minutes.

Mode #2 encourages you to unleash your creativity. You can use one or more of the ROM-programmed tone sequences, or invent your own. Key in up to 40 digits, each representing one of 16 tone pitches, and tell RaCon how rapidly to play them. With the right command sequence, RaCon will simulate sounds such as ringing telephones. Pseudo-random tone patterns are also on the menu.

Want to loan your RaCon to another hider? It's easy to change callsigns with a DTMF command. Worried about someone else accidentally or deliberately commanding your foxbox? Lock It with a DTMF command and RaCon will not respond to further commands until it hears its unique unlocking security code. (You cannot change the security code, so be careful about giving it out.) FCC rules prohibit auxiliary control links below 222 MHz, so if you're using the RaCon with a 2 meter transceiver, you must stay close to your hidden T so you'll be in "local control."

If you have a dual-band rig, the possibilities become more interesting. RaCon has a duplex mode, so you can command your dual-bander on 70 or 125 centimeters while it transmits on 2 meters. You can even play ventriloquist and talk through the hidden transmitter on the control link from your remote observation post.

By selecting the proper jumper configuration on the board, RaCon goes into the simplex or duplex fox mode when you apply power. Other jumpers select the proper PIT connections for various brands of handhelds and mobile rigs. RaCon requires +7 to +35

VDC at 33 milliamperes. Reverse supply polarity protection is provided.

Wait, There's More . . .

RaCon doesn't have to sit on a shelf between T-hunts. It has additional features that are useful around the shack. With a change of board jumpers or a command from your computer it becomes a DTMF decoder, a remote controller, a CW keyer or an automatic pager.

When someone makes a call on your local autopatch without identifying, you might be able to tell if it was a bootlegger and identify the culprit by decoding the number dialed. The RaCon board, connected to your computer's COM port, will do it. Digits received by RaCon's DTMF decoder IC are processed by the 6805 and sent to the computer in ASCII at 1200 BPS for display. In my tests, the SS1202 decoder had a wide audio level range and good performance even with noisy signals.

If you have an application for remote control by DTMF, you could write a PC

program to use the RaCon's ASCII output. For even more versatility, Byron has included a DTMF controller board with eight CMOS output lines on the data port. Tone commands set or toggle each bit individually. Return telemetry is provided.

The CW keyer function is useful for remote telemetry projects. RaCon converts ASCII letters and numbers from its RS232 port to MCW into your transceiver or an audio amplifier. Automatic push-to-talk keying during code transmission is included. You can set CW speed from 5 to 25 wpm with computer keystrokes.

With a one-line buffer, you can type ahead and have good-sounding code at 13 to 25 wpm. But if you use this feature to teach slow-speed Morse in your club's class, you'll have to time the character spacing yourself because Farnsworth letter spacing is not included. Byron plans to add it to a future upgrade.

The auto-page feature allows you to initiate telephone paging via radio with a five-character DTMF command.

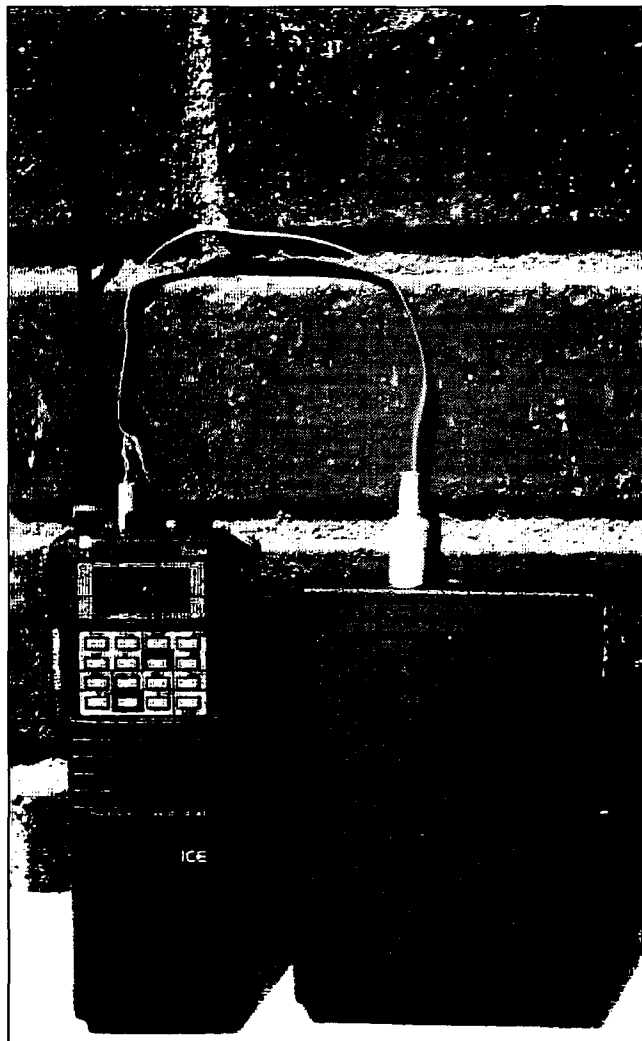


Photo A. The RaCon and a dual-band handheld with high-capacity battery make a complete remotely-controlled station. Progressive hunt enthusiasts have found these foxes hidden in hedges, tethered in trees, and buried on beaches. (Photo by KØOV.)

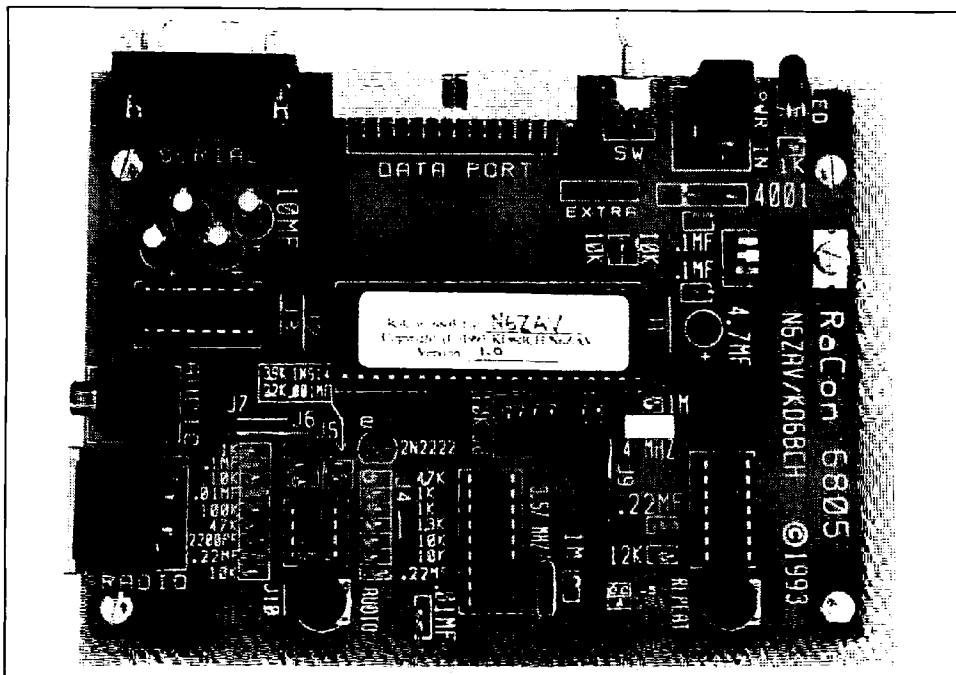


Photo B. The RaCon 6805 circuit board measures 4" x 5-3/8" and mounts in the cabinet of your choice. Timing is crystal-controlled, so two or more foxes can go on and off in sequence, staying in sync for hours. (Photo by N6ZAV.)

RaCon stays at your base station, connected to a transceiver and a 1200 BPS telephone modem with the X4 result code set. By your radio command from the field, RaCon tells the modem to dial one of four pager numbers and send one of four messages to the receiving beeper.

RaCon ID's back to you via radio that the page command was received. You can command it to beep your own pager to verify that your page was successfully sent. Enter pager and message numbers into RaCon's memory with your computer and COM port. You cannot reprogram the four pager numbers and messages from the field via DTMF.

This would be a great use for your old 1200 BPS modem. (Doesn't everyone use at least 9600 these days?) I couldn't test this feature with my modem because it's so old it doesn't have X4 result codes. However, I know it

works because N6ZAV and KD6BCH regularly page each other on T-hunts using a RaCon and modem at Marty's house.

Three Hours Well Spent

RaCon is available in kit form only. Assembly instructions are minimal, but parts are easy to identify and component locations on the board are well-marked (see Photo B). Sockets for ICs are included, so you can test the board before IC insertion to accommodate firmware upgrades.

The unit that I tested had been assembled by N6ZAV. To get an independent view of the kit version, I questioned Mike Musick NØQBF, who bought one for T-hunts in St. Louis, Missouri. "As a fox, it's marvelous," he wrote back on CompuServe. "It went together in about 90 minutes, but I'm an experienced board stuffer. I'd guess that it would take a ham with more con-

ventional background about two and a half or three hours." Mike built his board into an aluminum box with a Yaesu FT-411E handheld and two 1.2 ampere-hour batteries. "I field-tested it with a friend yesterday and everything worked fine," he wrote. "It came right up with nary a hitch, took commands the first time, coughed up the chosen cycles right on cue, and went on its merry way. Very, very clean operation."

It was hard to find anything negative in Mike's assessment of RaCon, but he had one suggestion: "Connectors and controls are on adjacent edges of the board, so it makes a poor fit in typical aluminum boxes with U-shaped walls. I would have preferred all the connectors on one end."

The RaCon 6805 kit, including circuit board and all components, is available for \$79 from Marty Mitchell, 340 Otero, Newport Beach CA 92660. Add \$3 for shipping. As usual, this offer is

not guaranteed by 73 Amateur Radio Today or by me. You must supply cables and cable connectors for your radio and computer.

The RaCon is truly a "one-gadget-does-almost-everything" device. However, it has a few important limitations. RaCon performs only one function at a time. For example, it will not do DTMF controlling and CW keying at the same time. Select your mode with computer or jumpers at turn-on; cycle it off and on to change modes.

RaCon has no EEPROM. User-programmed call signs, tone sequences, pager numbers and so forth are lost when power is removed, and it reverts to ROM defaults. If you need user programming, be sure to provide battery backup to cover momentary power interruptions. A 9 volt transistor radio battery works fine for this.

When talking through your hidden transmitter in duplex foxbox mode, remember that the fox's carrier remains on until you command it off, since there is no COR and no time-out timer. Be sure to include a CW ID cycle in user-programmed tone sequences. (It is automatically sent in the ROM-programmed modes.)

RaCon, like all digital devices, has the potential for radio interference (RFI), both incoming and outgoing. I found that RF from a hand-held scrambles RaCon's brains, but only if the antenna is within inches of the unenclosed board. Putting the board in a shielded metal case should prevent RFI problems.

Marty is upgrading the 14-page instruction manual to include troubleshooting information and more detailed descriptions of the various modes. N6ZAV and KD6BCH are giving good telephone support to RaCon builders. They seek user ideas for improved and expanded RaCon functions.

Heard of a new product for T-hunters? Let me know about it so "Homing In" can review it. A T-hunting Buyer's Guide installment of this column is in the works for later this year. Write to my Fullerton address above or send E-mail via CompuServe (75236,2165) or Internet (JoeMoell@cup.portal.com).

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Having Fun With Youth Forums

Now that the Dayton '93 Youth Forum is one weekend behind me, I can look back with a great deal of pride at the outstanding job done by all the youngsters who participated in it this year. A youth forum is one of the most effective recruiting projects for a club or radio organization, but you must be prepared and be willing to put lots of time and effort into it!

To a large degree, the preliminary work spent on getting the children and the event organized will determine how successful it will be. When preparing for a national convention, you should begin soliciting for articulate and accomplished young people months in advance. Most of the amateur radio publications will be happy to help you get

the word out if you give them enough advance notice. You should also take advantage of local club newsletters and school publications.

When getting ready for something as big as Dayton (I'm not sure anything else is), you'll want to attract children who will be at ease speaking in front of a large audience. I have found the recommendations of local hams to be valuable. Very often, the children they recommend have friends who are also licensed amateurs. Getting the word out on local repeaters is another good way to let folks know that you're interviewing young people who are interested in sharing ideas with other children and lots of other interested ham radio operators.

Contacting amateur radio equipment manufacturers is another important step to take. Let them know on official stationery that you will be conducting a youth forum. Advise them of how many people you

expect to have attending the forum, and be professional in detailing what your goals for the forum are. Yaesu, ICOM and Kenwood, along with AEA, MFJ and others, have always been generous in donating gifts or handouts to be won by youngsters attending these forums. At Dayton, Yaesu donated a 2 meter handie-talkie for the drawing at the Youth Forum. Let's be sure to support the manufacturers who are supporting educational efforts.

help available. There's no need to reinvent the wheel. Anyone contemplating a new youth forum or teaching young people should leave your forum knowing what to do next.

It is extremely critical that you spend time conversing with your prospective speakers at length. I try to get at least two phone conversations in before I make decisions. It's true that there is no fool-proof way to guarantee that a child

"Anyone contemplating a new youth forum or teaching young people should leave your forum knowing what to do next."

Next, it would be a good idea to contact the ARRL Educational Activities Department. Either Tracey or Rosalie will be happy to send you materials that you can distribute to interested teachers, instructors, and recruiters who will undoubtedly be attending the forum. Be sure to emphasize to prospective amateur radio teachers that there are lots of materials, books, curriculum packages and

won't get nervous or freeze up in front of a crowd, but you should be able to get a good handle on who is articulate.

Since all your speakers will probably be under 18 years of age, you should make it a point to introduce yourself to their parents. In many cases, parents will not be attending the convention and you will become the contact person for their child. Have all the information

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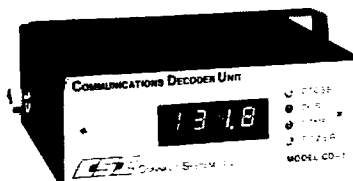
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CIRCLE 12 ON READER SERVICE CARD



Photo A. Some of the 1993 Dayton Hamvention Youth Forum speakers. Left to right: Rusty KD4GLC, Alex N9KYJ, Shauna N7NGT, Mike KB8LCC, Matt KC6VIM, Luke KO4IQ, and Eric KBØKQF.

Prepare a list of all the children's names, callsigns, addresses, and a brief summary of their accomplishments. This should be handed out to the audience members so that interested people can contact the youngsters if they wish.

I always make it a point to call everyone involved with the forum a week ahead of time just to make sure there are no last-minute hang-ups. You might feel more comfortable if you have each child supply you with a copy of his or her presentation. When you call them for the final time you can offer suggestions about what they plan to say. Make sure that the speakers understand what you are trying to achieve with the forum. One of my main goals is for non-ham children to attend these youth forums and listen to upbeat and enthusiastic youngsters relate what it is that they enjoy most about amateur radio.

There's lots of work and preparation involved in organizing a successful youth forum, but it's worth every minute to be part of a well-spoken, highly accomplished group of youngsters who are indeed the future of amateur radio.

Be sure to come and say hello at my next youth forum.

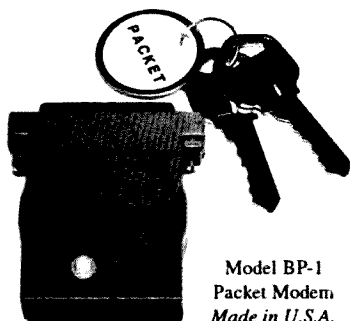
available for them, such as possible airline discounts, hotel recommendations and other transportation arrangements. Many conventions offer the speakers free admission, banquet tickets, food scrip, or

other amenities. Check it all out ahead of time.

Make a check list ahead of time to anticipate the audio-visual needs of your speakers and yourself. Double- and triple-check with the

convention forum liaison person that all the equipment necessary for the youth forum will be available. Don't forget to check out the equipment ahead of time on the day of the forum.

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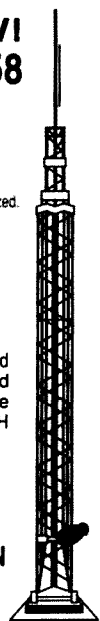
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The Ten-Tec Argonaut 509

Several months ago I described a home-brew classic, the Two-Fer. This month we'll look at another classic—the Ten-Tec Argonaut 509.

Even though this radio is slowly showing its age, it continues to be heard on all the bands, with the exception of the WARC frequencies. It has both SSB and the famous Ten-Tec QSK keying, making it a sought-after rig at hamfests.

One of the local hams called and asked me if I could look at his 509 because it would not transmit. After a few minutes on the phone to make sure that there weren't any misplaced wires or connections, we made arrangements for him to bring it over.

Since I have a 509 in my shack, I simply swapped out the plugs and connectors and replaced my rig with his. Turning on the power and setting the band switch to the proper position quickly proved that the receiver was very much alive and well. Several more minutes of knob-twisting proved that the receiver worked on all bands. So, switching over to the dummy load, I turned the mode knob to tune and adjusted the RF power control. Sure enough, the output meter just barely moved with the gain control fully clockwise. Yup! The transmitter was dead. Just to make sure the

problem was not only on one band, I tested the rig for transmit on all bands. Again, the RF output meter just barely inched up, telling me that the transmitter was indeed dead. Off to the testbench we went.

Fixing an Argonaut 509

The Argonaut 509 is easy to work on. You'll be flipping the 509 back and forth, so place something soft on your work surface to protect the case from scratches. A heavy bath towel works very well. Most of the case parts come apart to allow you access to the insides.

"Under no circumstances should you try to adjust the sealed coils (T1 and T2) on the receiver front end."

Start by removing the top case. There are two screws on the back holding the case top to the back panel. After the screws have been removed the top slides off. A small metal bracket holds the speaker to the top case. Release the speaker by removing the screw holding the speaker. The speaker will still be connected to the audio jack so be careful that you don't pull the wire either off of the speaker or out of the jack. After you remove the top, what you see is just the top half of the 509; the bottom is just about as full of modules.

The first thing to do is check for loose plug-in boards. When Ten-Tec originally installed the sockets for the plug-in modules they got a good batch. Unless you constantly plug in and remove a board, you won't see the socket wear out. I've never seen a bad socket in a 509. Still, let's not ignore what may be the obvious problem. The plug-in boards also have screws holding them in place. As I said, it's very rare to find a loose module in a 509, but check just the same.

The top half of the Argonaut 509 consists mostly of receiver boards and the control board. Looking down into the rig, with the front panel directly in front of you, you will see the control board on the right. On the left are the ganged tuned circuits for the front-end receiver; the low-level RF drivers for the transmitter are right under the cage.

Under no circumstances should you try to adjust the sealed coils (T1 and T2) on the receiver front end. You must have the proper test equipment to align these coils. You can't do it by ear, and you can't align them by watching the meter. In two words, "DON'T TOUCH!"

Without missing a heartbeat, I went directly to the PA, located on the bottom half of the 509. You must remove the bottom plate to get to the PA. There are several screws you must remove before you can get to the bottom of the rig. Notice what

screw goes where as which have machine threads and which are self-tapping. After the screws have been removed, slide the bottom plate off.

Right behind the large VFO box, toward the rear of the chassis, is the PA module. It's a plug-in module too, but the heat sink for the transistors is screwed to the main chassis. You must remove this screw to release the module.

I worked for a computer shop part-time fixing Apple computers way back when. Their service policy is outstanding. It went like this: "Try this . . . try that . . . replace the motherboard." So, having a second 509 at my disposal, the cheap and dirty way to check the PA was to swap it out with my known good unit. That's exactly what I did. After I tore apart my 509, I exchanged the PA modules.

Powering up the suspect rig, I plugged in a dummy load and flipped the mode switch to tune. Rats! I had just put in a known working PA module and there was still no power coming from the transmitter. So, not to be outdone by a simple problem like this, I installed the "dead" PA module in my 509, applied power, and the RF output meter swung up full-scale. It looked like the PA was good and there was something else wrong with the 509. Back to the testbench with another game plan.

The next step was to look for the proper T/R voltages. It's a simple test and requires only a VOM. Ten-Tec's manuals are very complete when it comes to voltage checks and circuit schematics for each module. All the needed T/R voltages are clearly listed. They are labeled "T" and "R" voltages on the schematics.

The T/R voltage must change when going from receive to transmit. It's a very sharp jump in voltage from less than 1 volt to about 10 volts. There should not be any voltage in between the two—it's either on or off.

Everything seemed to be fine, but since I had my 509 apart, why not switch out the control board. The control board generates the REF voltage for the VFO, along with the T/R switching voltages. This sounded good to me so I put my good control board into the dead 509. Again, no transmit with the new control board. I reinstalled the board I had removed from the dead 509 into my 509. It worked just fine. I then swapped the boards back, and guess what? My 509 wouldn't transmit. What started out as a simple fix had now killed two Argonaut 509s. For some people the birds sing!

Was there something in the rig that blew up my control board? Nah, the one I took out seemed to work just fine. But what could have killed my control board after I put it into the second rig? Well, first things first, and that meant fixing the transmit problem in the first 509.

I knew that the PA module was OK so lack of RF drive had to be causing the problem. The low-level drive comes from a non-removable PC

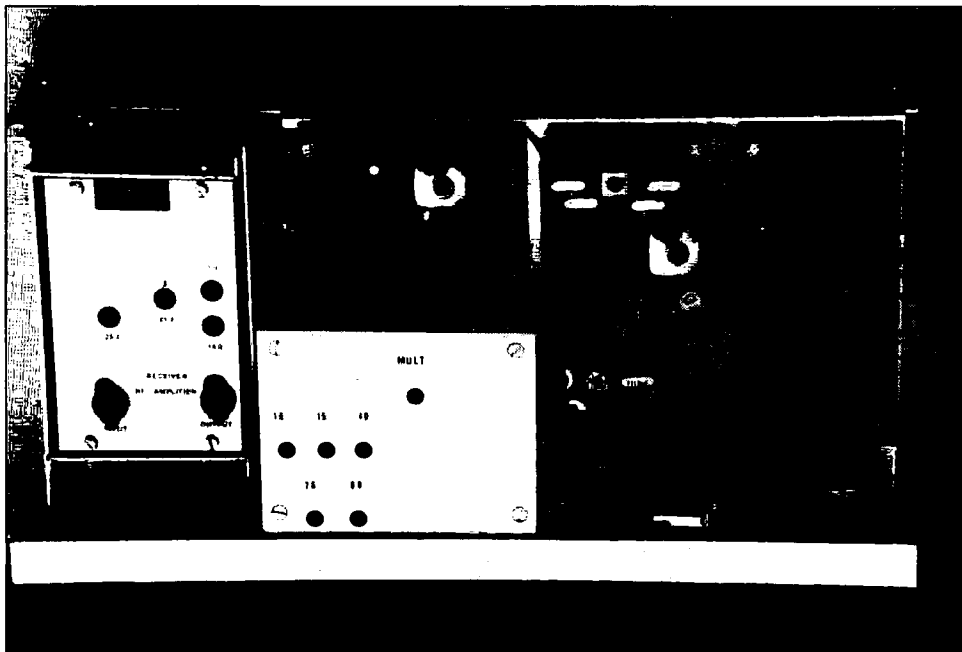


Photo A. Looking down from the top of the Argonaut 509. The right side of the photograph shows the control board. The large box in the center is the VFO compartment.

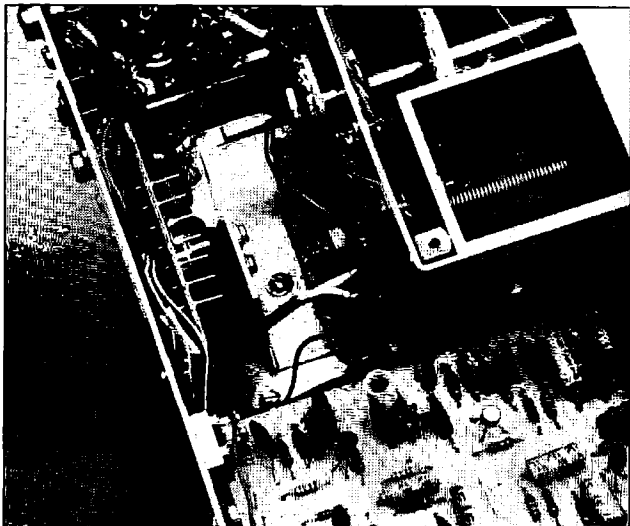


Photo B. The PA heat sink is shown directly below the VFO compartment. Notice the screw holding the heat sink down.

board deep down inside the receiver's front end. It's not easy to get to—this requires a major tear-down to accomplish. However, there is an easy way to check for proper operation of the low-level driver.

You'll need either an oscilloscope or an RF probe and VTVM (or high impedance VOM). Since both the low-level driver and the PA driver

transistors have their collectors connected to their cases, we can tell if there is any signal gain between the two. You'll need to remove the top of the receiver front end tuning cage. Be careful—you don't want to break any of the slugs or damage any of the coils. The cage will lift right off the top. Lay it aside for safe-keeping. Now, take your test probe

and touch the case of the low-level driver transistor. Set the scope to measure 0.5 volts peak-to-peak. Also, set your scope to read only RF and not DC voltage. Flip the 509 to transmit and slowly increase the drive control. You should see the RF voltage on the case increase. If you don't, that transistor or the stage feeding it is bad.

The next step is to leave the drive control where it is and move your test probe to the collector (case) of the PA driver. You should see a *large* increase of signal. Now, adjust the drive control and verify that the signal increases or decreases as you run the control through its range.

what? Four watts of RF into the dummy load. I still had no indication on the 509's meter, though.

And that's where we'll pick up next month, I'll finish the troubleshooting and tell you where the problem is and how to fix it.

If there is something special you would like to see here in the "QRP" column, please drop me a note. Perhaps we'll dig into a subject you would like to know more about. Who knows, we both might learn something when breaking new ground.

QRP ARCI

If you have been thinking of operating QRP and would like more infor-

"If there is something special you would like to see here in the 'QRP' column, please drop me a note."

If you don't see an increase between the two transistors, then either the PA driver is bad or something in between the two is shot. In my case, I had plenty of gain in both stages but still no output from the RF PA. So, I moved to the collector of the PA itself. Whoa! Plenty of RF coming out of this critter. What I did next should have been done days earlier—I connected up a wattmeter to the 509, flipped the mode switch to lock, and guess

mation about QRP and the QRP ARCI, you're in luck. I've just finished printing the new PR handout for the QRP ARCI. You'll get membership forms, a sample of *The QRP Quarterly*, and a short guide about the club and QRP in general. If you would like a copy, all you have to do is send me (at the address at the beginning of this column) either \$2 for postage or \$2 worth of stamps and I'll send a PR package your way.

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Simple Gray-Scale Generator

While at this year's Dayton Hamvention, I had the pleasure to meet with Mike Sheffield ZL1ABS from Auckland, New Zealand. He gave me a schematic of what has to be the simplest and cheapest source of video I've ever come across. Using just one CMOS logic IC, this circuit generates a beautiful gray-scale pattern which is perfect for adjusting monitors and TV receivers for proper contrast and gives you an inexpensive source of video for your ATV transmitter. This gray-scale generator is very compact and draws very little current—I used a 9-volt battery to power my circuit.

How It Works

The heart of the gray-scale generator is a 14-bit binary counter IC with an on-board oscillator (see Figure 1).

As the counter increments, a stepped output voltage is generated, thanks to the voltage divider network connected to outputs Q4-Q6.

When the counter activates Q7, the circuit resets and repeats the sequence. This reset signal essentially divides the 1 MHz clock frequency down to the video horizontal line frequency of 15,625 kHz (European standard). Keep in mind that we are not generating vertical sync with this generator, just a stepped voltage that repeats at the horizontal scan rate. The end result is a series of continuous vertical bars that increase in brightness from left to right on your monitor.

The NTSC Modification

Since this circuit originally appeared in the British Amateur Television Club's magazine *CQ-TV* (issue #138, p. 34; and #145, p. 74—Figure 1 is ZL1ABS' modified version) it was designed for the European horizontal line standard of 15,625 kHz (625 lines of video at a 50 Hz rate). The U.S. horizontal line frequency is

15,750 kHz (525 lines of b/w video at a 60 Hz frame rate). When using the circuit shown in Figure 1, you may have to adjust your TV set's horizontal hold to compensate for the different line frequency.

In order to generate a horizontal line frequency on 15,750 kHz, I searched the catalogs for an appropriate (and cheap) crystal. I finally found a 4.032 MHz crystal in the Digi-Key catalog. By increasing the divide rate by 4, you can now generate an exact NTSC output. Also, since 1 MHz crystals are quite expensive (about \$10), you save quite a bit by using the higher clock frequency). See Figure 2 for the NTSC standard gray-scale circuit. I added a 5 volt regulator to provide a steady video level if the supply voltage varies. The voltage regulator is optional as the circuit will work with a supply voltage from 4 to

12 volts. If you'd like to use this new circuit for European standard video, just use a 4.000 MHz crystal.

I hope you enjoy this unique generator. If you'd like to play with some variations of the gray-scale output, try moving the reset and voltage divider resistors to different divider outputs (I.e. instead of connecting them to output pins Q6-Q9, try connecting them to Q7-Q10).

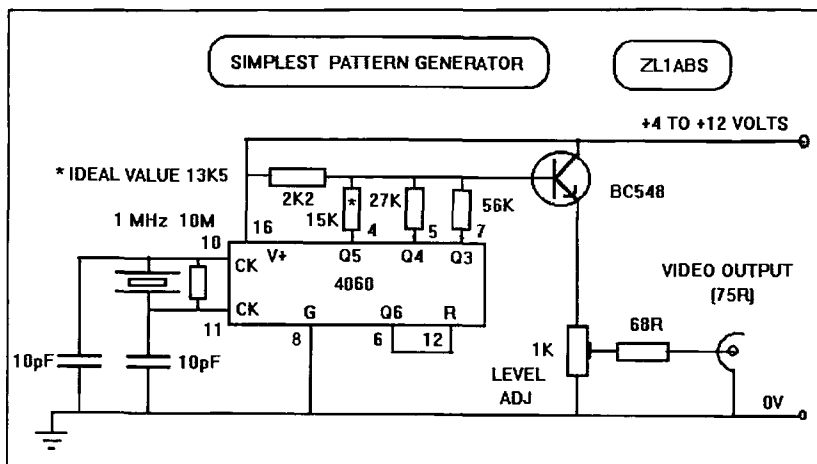


Figure 1. The original gray-scale generator (European line standard). Modified by Mike Sheffield ZL1ABS from circuits appearing in CQ-TV #138, p.34 and #145, P74.

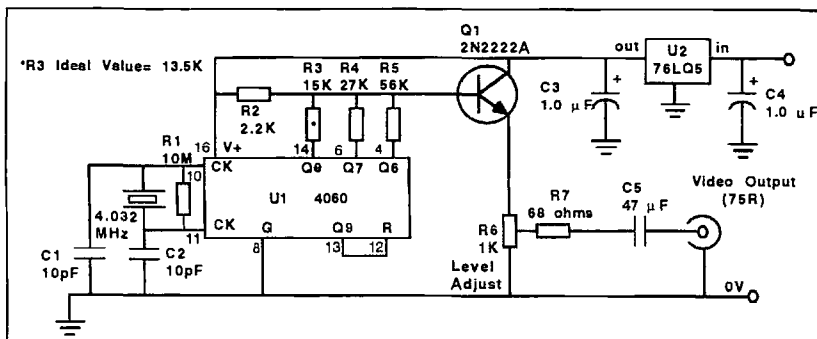


Figure 2. The simple gray-scale generator modified for NTSC U.S. video output (horizontal frequency of 15.750 kHz).

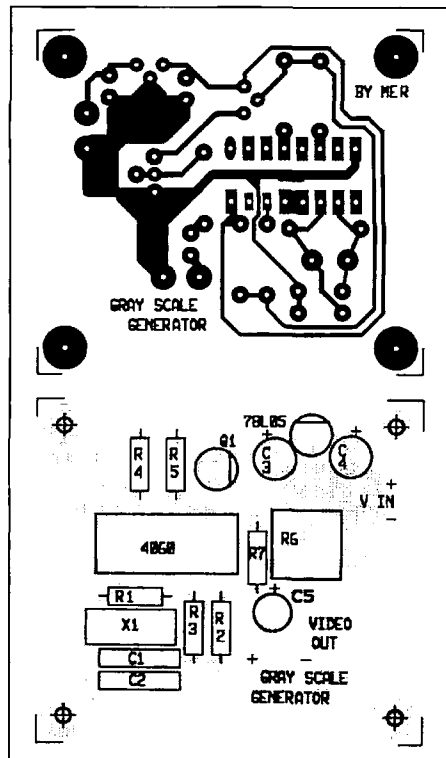


Figure 3. PC board foil pattern and parts placement for the NTSC version of the gray-scale generator.

Parts List for Figure 2

C1,C2	10 pF capacitor	Digi-Key# P4837
C3,C4	1.0 uF tantalum	Digi-Key# P2059
C5	47 uF tantalum	Digi-Key# P2042
R1	10 MEG resistor	Digi-Key# 10MQ
R2	2.2k	Digi-Key# 2.2KQ
R3	15k	Digi-Key# 15KQ
R4	27k	Digi-Key# 27KQ
R5	56k	Digi-Key# 56KQ
R6	1k potentiometer	Digi-Key# 3386P-1K
R7	68 ohm	Digi-Key# 68Q
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Q1	2N2222A transistor	Digi-Key# PN2222A
U1	CD4060B	Digi-Key# CD4060BCN
U2	78L05 5-volt regulator	Digi-Key# AN78L05

A blank P.C. board is available for \$3.50 plus \$1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

A complete kit including the P.C. board is available for \$15 ppd. from Elektronics, 12536 T.R. 77, Findlay OH 45840; tel: (419) 422-8206.

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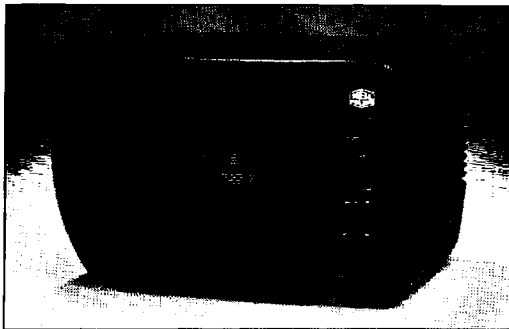
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Compiled by Hope Currier.

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The SA-1 (near right) from Heil Sound, a new compact sound system for amateur radio receivers, will allow operators to hear weak signals, sort out the rare DX, and hear audio quality never before available to radio amateurs. The unit contains a high quality 5 watt amplifier and a 4" broadband speaker working into a ported acoustic cavity. A variable equalizer is built into the amplifier, allowing the operator to adjust the audio for maximum articulation. The extended response, added efficiency and additional power output from the SA-1 will lower your noise floor, increase articulation and allow you to copy signals that used to be impossible to hear.

The new PRO-SET (far right), is another entry from Heil Sound's continuing line of products developed by and for the amateur radio market. The unique qualities of this head-



set/microphone make it particularly useful for multi-op contesting and DXpeditions. It has an adapter type cable to facilitate dozens of connector pinouts for various rigs. There are three different PRO-SET models, with differences in the type of microphone element used. The vinyl earpad ring mount snaps into the headpiece for easy removal for

washing or replacement.

The headband is fully padded, with detent stops for each side. The unit is light but extremely rugged. The microphone boom is flexible and can be placed in just about any location, or can be folded up for traveling and storage.

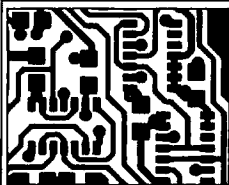
The estimated retail price for the SA-1 is \$89.95; \$134.95 for the



PRO-SET. For more information, contact Heil Sound Ltd., Heil Drive, Marissa IL 62257; (618) 295-3000, Fax: (618) 295-3030. Or circle Reader Service No. 201 for the SA-1; Reader Service No. 202 for the PRO-SET.

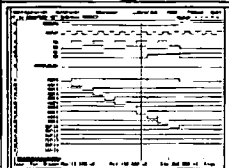
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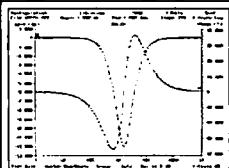
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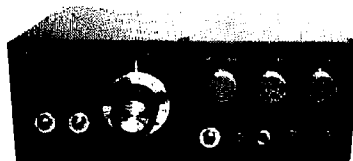
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TWT Power Amplifiers

This month I will cover the microwave amplifiers called "TWTs," or Traveling Wave Tube amplifiers. TWTs are the high-powered amps that were used for the moonbounce operations described in last month's column. The 10 watt units that I present here are somewhat lower power than the 28 watt type used by Charles Suckling G3WDG, or the very high-power TWT used by WA7CJO. In either case, the principles are the same but the higher power units are more desirable for moonbounce.

TWTs are the real holdouts for vacuum tubes in this age of solid-state design. The 10 watt TWTs (5 and 10 GHz) in commercial market use have been replaced by solid-state designs. However, in surplus they are somewhat rare. The very high-power devices still have many applications today and are used for satellite transmission both on earth stations and in space.

This month I'll look into the letter file, which is getting deeper due to the fact that I have spent most of my time recently on jury duty—I've been on a case for about five months. Needless to say, this is taking a toll on my amateur radio activities, but I should begin to take up projects again in a few weeks or so. There are so many different projects that I want to get into, but without adequate time I can't do them justice. I'll get back on the ball very soon; please bear with me.

The HP-491C

Jim N5TSP is in the process of building several stations for 1296, 2304, and 3456 MHz, using Down East Microwave transverters (check almost any issue of 73 Magazine for their advertisements). Jim writes that while he was in Southern California he ran across a Hewlett Packard HP-491C TWT amplifier rated at 1 watt output for 2 to 4 GHz operation.

He has several questions concerning the HP amplifier. First question: Do I know of anyone using these amps on 2304 and 3456 MHz? Well, Jim, I do not personally know of anyone using this amp but that does not preclude it from working well for you in this application. I use similar TWT amplifiers and they work quite well. The amplifier you picked up was originally intended to increase the output power from Hewlett Packard

signal generators (max 0 dBm) to higher power levels up to 1 watt for power applications.

Different generators require separate TWT amplifiers for their respective frequency ranges. Drive power for the TWT to put full output power (of 1 watt) is 1 mW or 0 dBm. They will also work "as is" in the FM and SSB mode of operation. The only modification involved is switching. That is because the units were intended to be manually switched on and off by means of toggle switches.

Second question: Can the power output be pushed up if it's being used in an intermittent duty cycle? Power output depends on a lot of things in TWT amplifiers. This type of amp is self-contained, with the high voltage regulated power supply inside the rack mount cabinet. Output power depends on tube condition and the precise voltage (+/-1%) on each particular element. Power can be increased by making adjustments to peak operation at a particular frequency vs. broadband operation. I would not expect to get much improvement (such as doubling output power). You might get 1-1/4 watt output at best. I suggest you leave it alone unless you want to experiment. What you get initially is about all you will ever get unless the power supply is out of adjustment. A small percent error here can mean a large microwave power output error.

Question three: Does anyone have documentation or info on modifications for the HP amplifier? On this one I will have to wait for help from our readers. I'll keep my eyes open. Our local surplus store has several of these amps for 10 GHz, but no manuals or even a schematic. If you choose to tinker with the unit, be cautious because the power supply for any TWT amplifier uses voltages in the several KV range. True, the current can be low, but the voltage is quite high and that is not only dangerous but lethal.

I hope this answers several questions. As a matter of general interest, these TWT amplifiers came in a series of units like the 491-C. The model 489-A works from 1 to 2 GHz, the 493-A from 4 to 8 GHz, and the 495-A from 7 to 12.5 GHz. Each unit works on different frequency bands from 1 GHz to over 12 GHz. For a low price, these units can make a good mid-power amplifier unit for base operations. All units in this series are rated to 1 watt power output. (Note: Drive requirements of the TWT are near 0 dBm/1 mW, making it drivable from a mixer or single-stage amplifier for

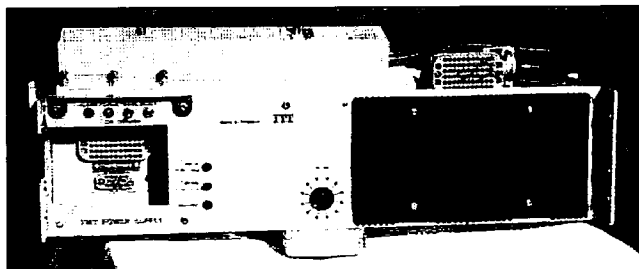


Photo A. 10 watt ITT power supply and TWT tube.

full output power.)

Many other manufacturers have made similar amplifiers. Hughes Aircraft made a similar unit to the HP-491, but these units are normally rated in the 10 and 20 watt level range. The TWT amplifiers that I am most familiar with are the ITT PW5C11C for the power supply, and the W3MC15C 10 watt TWT tube for 10 GHz. This unit is somewhat different; the power supply and tube are independent of each other and attach together by a single multi-conductor high voltage cable. A little terminology might be in order here. If the TWT unit is self-contained it is called an "amplifier." If it is separate (i.e., the tube is separate from the power supply), it is called by its component part names even though it is still a complete amplifier in all respects when connected together.

The ITT system that I use requires a DC system that is positive ground, negative 24 or 48 volts for operation. The ITT units were made in England so only surplus quantities of these units appear in the US. Far more popular, though, are the Collins Microwave units which came from Richardson, Texas. (Note: This source does not exist today.) Collins made this unit for the telephone industry, in which negative 24 and 48 volts is standard power.

I have several of these working units, and a couple more dead ones I rob for parts. Needless to say, this is the unit that Kerry N6IZW and I use for our 10 GHz stations. Originally, this unit was made to work in the commercial band of 10.7 GHz to 12.7 GHz. No re-adjustment is needed to operate on 10.368 GHz. I expect a little degradation in output power due to the lower frequency, but for the most part I ignore it. (See Photo A.)

Another manufacturer of TWTs is Varian Electronics in San Carlos, California. I have some of their units, but no schematic details. They are quite similar to the ITT units (positive ground), but do not require internal changes for DC input voltage variations. Both the Varian and the ITT TWT amplifiers operate on the

10 GHz band and have an output power of 10 watts. (See Photo B.)

Another TWT manufacturer is Thompson CSF Electronics. The unit that I have is a 6 GHz TWT very similar to the 10 GHz unit in that both power supplies were made to operate on 24 or 48 volts and positive ground. The TWT is external to the power supply. Again, this is a 10 watt unit. The Thompson model number is TH-21543 RM (rack mount), with a TH-3543 TWT tube. (See Photo C.)

Caution: Please note that while the Thompson and ITT power supplies look alike, they are not interchangeable. All tubes are keyed differently. However, they all have the same type of plug mounted on the end of their short cables. Don't let this cause you to make a mistake and use the wrong power supply with the wrong tube. If you try this you are in for quite a disappointment. Tubes and power supplies are all different and each requires its own special arrangement.

Part of the problem is that each tube requires slightly different voltages on elements of the TWT tube. Additionally, some of the tube elements do not come out on the same pins for all tube types. This is to help prevent the wrong tube from being connected to the wrong power supply. In most cases, interlocks wired into the tube socket prevent the power supply from being activated. But, according to Murphy's Law, it could be devastating at the worst possible moment. If you see such amplifiers in the surplus market, make sure of what you are buying. It might look all right connected up to the external tube, but CONFIRM THAT THE TUBE AND POWER SUPPLY ARE FROM THE SAME MANUFACTURER. I can't stress that enough! See Figure 2 for the DC power supply connections for the units described here.

There are solid-state alternates to TWT amplifiers. These units can take the shape of something similar to the satellite amplifier that I described in the September 1992 issue of 73. There I de-

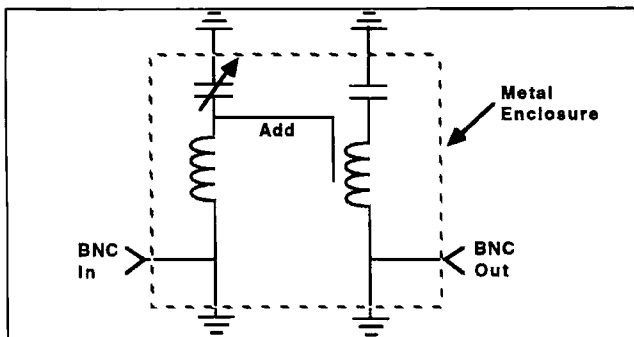


Figure 1. 2 meter filter and added coupling arrangement.

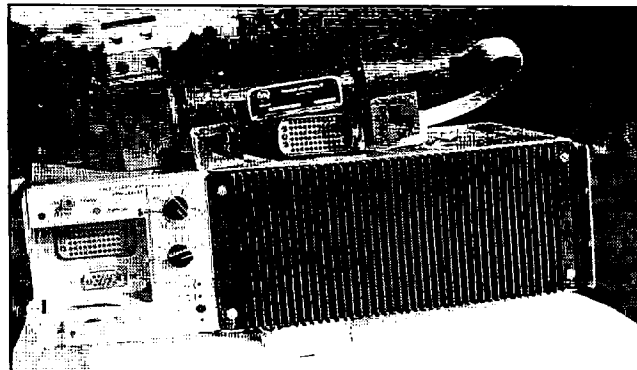


Photo B. 10 watt Varian power supply and TWT tube.

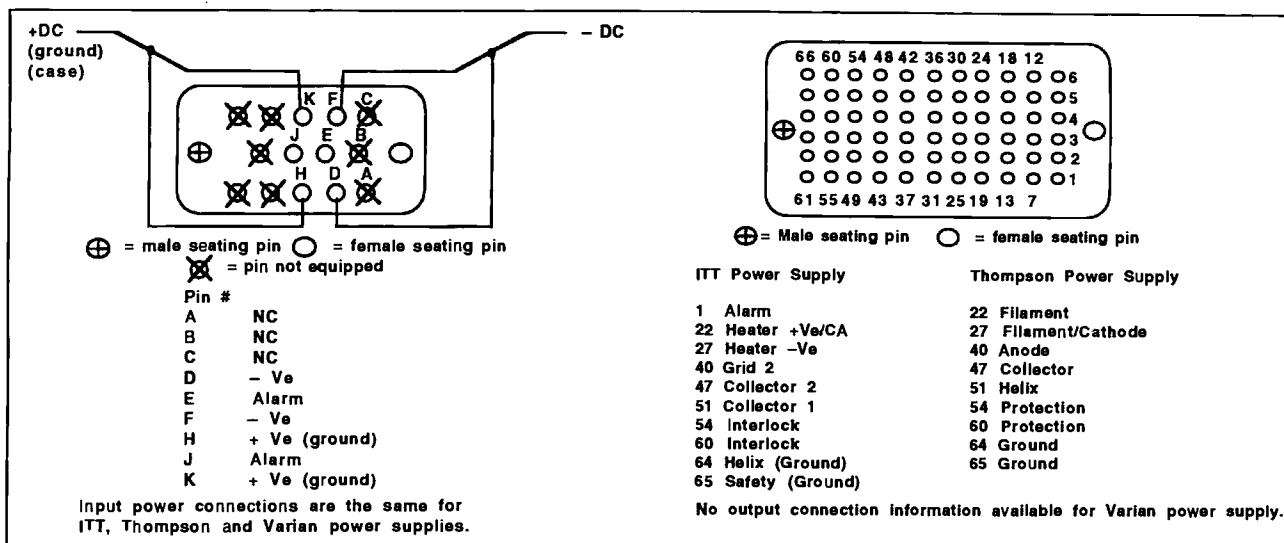


Figure 2. DC TWT power supply connections.

scribed converting a 1/4 watt solid-state amp from 14 GHz to the 10 GHz amateur band. I suspect that there will be quite a few devices similar to this unit, for many different frequency bands, showing up in the surplus market in the not-too-distant future.

Military surplus stores sometimes have some very good buys, but you'll have to really look carefully. If you're lucky you'll arrive just when the truck is unloading and get first shot at it. I've found several solid-state amplifiers, covering many different bands of operation. To date, I have gathered quite a collection of devices to aid construction of converters for several of our microwave amateur bands.

I consider some of these amplifiers as part of the class of hard-to-find materials I call "UNOBTANIUM." With military manufacturing in its current state of transition, I believe that there will be lots of new surplus material, including solid-state amplifiers. You've just got to keep your eyes open and keep a little cash tucked back in your wallet to take advantage of the opportunities when they arise. I'll get into solid-state amps next month.

Concerning the wallet, I was severely bitten by being \$20 short on a deal quite a few years ago. I don't think I will ever get over it. I missed out on a 2-cubic-

foot box full of RF power transistors at an auction due to 20 bucks! What made me so frustrated was that the material was in with some junk that went for peanuts and I was the only one who knew the devices were in that auction lot. I did my homework, but I didn't cover the financing. I have to chalk this one up to experience, for it taught me a very (expensive) valuable lesson. Oh well, you can't win 'em all.

Mailbox

Dominick N2LDJ states that he constructed two filters, the alternate spaced air coil and the variable capacitor filter (see "Filters for 2 Meters," "Above and Beyond," December 1992). "Although both filters work fine in removing intermod during receive, I can't tune up these filters on transmit. I am using an SWR/power meter to adjust and tune, but it appears that the filters on transmit are 'dead,' no power out. I have tried the methods to tune the filters as described in your article and have double-checked my connections, but still no luck. Help!"

Of course I will help. I believe that the spacing or coil-to-coil coupling might be too loose, meaning there's not enough coupling between circuits. As you state, they tune just fine on receive so the filters are peaking up in the receive mode. I suggest you add a coupling capacitor

between sections of the filters. This can be a small 2 to 3 pF capacitor, or even be a "Gimmick Capacitor." By gimmick capacitor I mean we form a capacitor out of a short piece of large diameter wire that is directly soldered to one of the tuned circuit's variable capacitor solder post and the insulated portion of this wire is brought in close proximity to the other coil. This, depending on position, will add the required coupling. See Figure 1 for a brief drawing detail on the added inner coil coupling.

Paul KB8CMW writes that I have provided lots of details on the Frequency West type of brick oscillators and covered some of the mods to these oscillators. "Do you have any information on the California Microwave bricks?" Paul states that he would like to get some information on modifying the filters. He is interested in tuning these filters for the 23 or 13cm bands. Paul is interested in any information on the retuning of this type of filter.

Well Paul, yes I have retuned these filters, but be assured these filters do not move very far from their original frequency. The lower the brick output frequency, the less the filter can be retuned. I use a rule of thumb that says most bricks can be retuned something like 5% of the original frequency. It's not exact, but in most cases it works fine.

On some rare occasions I have moved 8 GHz bricks to the 10 GHz range, but that is stretching the tuning to an extreme. All 8 GHz units will not tune that far, but some will.

I find it's better to retune, say, an 11 GHz brick to the 10 GHz range. This almost always works, except for broken or striped or locked tuning screws in the filter, making readjustment impossible. To retune almost any type brick you have to determine which filter type you have. Frequency West has two types: one with lock nuts on Allen screws, and the other with Allen screws on top (no lock nuts). To tune the one with no lock nuts you have to remove the diode multiplier filter portion from the brick top. The lock screws are on top and the tuning screws are inside the filter opposite the side of the RF output connector. To make adjustments on this type unit, the filter is reversed and placed back on top of the brick in a somewhat unstable position. The RF probe is placed back in the hole for RF drive to the filter multiplier. When it is installed this way, access to the adjustment screws is very easy. When it's complete, reposition the filter back in its normal position.

The adjustment procedure for the Frequency West brick that has the lock nuts is quite easy. All you have to do is build a special tool to relieve frustration. Take a nut driver to fit the locking nut and drill a hole through the handle to accept a small brass rod. To the end of the brass rod drill a hole to fit the Allen screw on the adjustment screw. Use the tool to, in one motion, loosen the lock nut and make adjustments with the brass rod/Allen wrench. These screws are under the top blue label.

For the California Microwave brick the procedure is somewhat the same as for the Frequency West brick without lock nuts. Unfortunately, it's a little tougher. The problem is that part of the RF output connector has to be moved in order to reposition the filter back on the brick. This enables you to loosen the top lock screws and gain access to the internal filter screws, all of which are very small Allen-heads. Adjust the frequency in small increments.

As always, I will be glad to answer questions related to this and other topics. For a prompt response please send an SASE. 73, Chuck WB6IGP.

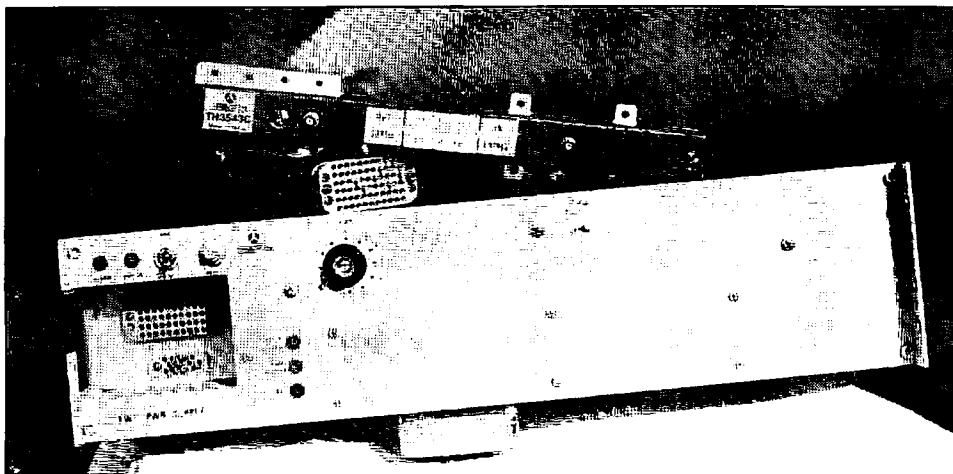


Photo C. 10 watt Thompson CSF power supply and TWT tube.

Your Tech Answer Man

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The Scope of Things

Last time, we were discussing the ins and outs of oscilloscopes. Let's continue where we left off.

Double Vision

Why the heck would you want to see more than one waveform at a time? Well, as it turns out, it's incredibly useful. The basic structure of electronic devices is such that signals can be viewed in a series of stages. Each circuit stage does something to the signal inputted to it and then feeds it to the next stage. Some stages have several inputs, several outputs, or both. But the point is that any given stage changes the signal in some way. Perhaps it's a current amplifier. If so, it makes the signal carry more current so it can drive a bigger load. Or, perhaps it's a mixer. Then, it takes two or more input signals and produces a composite output signal.

A multiple-channel scope lets you see the input and output of a stage at the same time. Let's say you're looking at a voltage amplifier stage in the distorted audio amplifier of your 2 meter rig. The signal goes in and is supposed to come out the same, only bigger, right? So, you look at the input signal and, sure enough, it looks like audio. Then, you look at the output signal and, yup, it looks like bigger audio. So, the stage must be OK, right? Wait a minute. How do you know that the output's a decent replica of the input? Here's a great way: Connect one channel of your scope to the input, one to the output, and then turn the second channel's sensitivity down so that the waveforms are the same size on the screen. You should be able to superimpose them and they should look the same. If not, the radio's stage has significant distortion, which is just what you're looking for! (Actually, there's an even better way to use a dual-channel scope to find such a problem, and we'll get to it a little later.)

Another vital use for multiple channels is observation of the time difference between two signals. If, say, a circuit is supposed to delay a pulse by 15 microseconds, how do you tell if it really is working? By connecting one channel to the input and one to the output, you can actually measure the time difference between them. In fact, alignment of high-tech gadgets like VCRs and digital tape recorders is impossible without such measurements. And digital beasts like the frequency synthesizers in your radios often yield to such techniques, too. For that matter, any kind of phase shift or time delay can easily be seen and roughly measured.

How Many?

It is possible to make scopes with

just about as many channels as you want. Naturally, the cost goes up with each additional channel. Although you can buy quadruple-channel scopes, they aren't common. In fact, there are 8- and 16-channel scopes designed for digital work, but they cost two arms and a leg. Besides, you really don't need something like that anyway.

The most common kind of multiple-channel scope is the dual-trace unit. In fact, the 50 MHz dual-trace scope is a staple of modern electronics servicing. Let's look at how to use one.

I'd Rather Switch

Although some early dual-channel scopes actually had two separate electron beams in their CRTs, that was always uncommon, and it's unheard of today. Today's scopes have two traces, but only one electron beam. How do they do it? Just as you might expect . . . they fake it! There are two ways: One, the first trace is drawn and then the second, so fast that you can't see it happening. Two, the trace rapidly switches back and forth between the two traces, drawing bits of each as the beam sweeps horizontally across the tube. The first method is called an *alternate sweep*, and the second is called a *chopped sweep*.

Both methods work well, but each has advantages and disadvantages. Alternate sweeping becomes visible and annoying if the sweep speed is slow enough; one trace disappears while the other one is being swept. When using slow sweep speeds, the chopped sweep gives a much better illusion of having two simultaneous traces. Chopped sweeping, however, has the limitation that the chopping frequency (the speed at which the beam jumps back and forth between the traces) must be much higher than the horizontal sweep speed itself, or you'll see the chopping as a series of square waves, which, of course, is what it really is. So, you use an alternate sweep at high sweep speeds. Most dual-trace scopes let you select either method, but some do it automatically, depending on the sweep speed you choose.

There's one more way to see two channels at the same time: mixed together! Remember our discussion of the distorted audio amp? Well, what if we take the input and output, connect them to our channels and then mix the channels together? If we use the vertical amplitude controls to make them the same size, they'll exactly double, right? That doesn't do us much good, but what if we *invert* one of the channels? If you'll recall from last month, most scopes have a switch which lets you do that on at least one channel. Now, the signals should exactly cancel each other out, leaving a straight line! If they do, you know there's no distortion in the amplifier. If not, you can actually see the distortion products without the original signal, because you've canceled out what *should* be there! Pretty neat, huh? In practice, you do it

by playing with the output channel's variable amplitude control until the line is as flat as it can be. Whatever's left is the difference between the two signals, not counting their gross amplitude difference. Real circuits always show some difference signal, but you can get a pretty good idea from its size and shape whether it's reasonable or not.

It's About Time

I think we've covered just about everything vertical there is on an oscilloscope. Now we get to the fun part: time. At first musing, it would seem to be pretty simple. You select your sweep speed and you're done, right? Well, you can do that and, often, it's all that's needed. But, there's lots more and it's all pretty handy stuff.

Pull the Trigger

Before we get to all the neat things you can do, we need to consider one interaction between the horizontal and vertical domains. In order for you to see a waveform, it must have one important characteristic: It must repeat. Why? Because otherwise it would flash by and be gone before you'd even notice it. To be visible, the beam must trace over the same places on the CRT over and over. Unless you have some method of storage, such as digital memory (which we'll get to later), waveform repetition is an absolute must. (And, if you're looking at two signals at once, they must be harmonically related or one of them will be just a blur.) In the case of a sine wave, square wave or other simple wave, the point of repetition is obvious: once per cycle. But what about a TV signal or a digital pulse train? Such a complex signal may have all kinds of "cycles" within it and more than one point which could be considered the start of repetition. TV is a good example because it has vertical sync, horizontal sync, color sync, equalizing pulses and more, all organized into a big, long train which truly repeats only every other field! Finding the spot you want takes a good understanding of the entire signal. What's worse, depending on what you pick for your starting point, what you'll see can vary tremendously!

It should be clear that, even for the simplest waveforms, it is necessary to start the scope's trace at the same point on the waveform for each sweep. So how do you pick any spot to begin with? You use the scope's trigger controls. These consist of a variable knob and a few buttons. The knob varies the voltage point at which the trigger "grabs" the signal and starts the sweep. Generally, it's an uncalibrated control; you just turn it until the blur on the screen freezes. Usually, you can pull it out and reverse its slope, which refers to whether it grabs the waveform as it rises in voltage or falls. Doing that lets you start with a different part of the waveform, which may be just what you need in a given situation.

The buttons let you select how the signal is coupled to the trigger circuitry. They function in much the same way as the coupling buttons on the vertical channels. With DC coupling, you trigger on an absolute voltage level. Often, that's fine. But, if you want to

trigger, say, on a particular variation in a 100 mv signal that happens to be riding on 12 volts DC, you would be better off using AC coupling and blocking the 12 volts altogether. Some scopes offer low-pass and high-pass filters on the AC coupling. They are very nice because they let you avoid triggering on noise (with the low-pass filter) or trigger on a high-frequency component of the signal while ignoring its slower changes (with the high-pass filter). Ultimately, you use whatever gives you the view you need.

Some signals are so complex that it is impossible to trigger on them at all! No matter what you do, the trace keeps jumping around, making measurements impossible. Digital pulse trains are notorious for it. Some scopes have a *hold off* control which sets a variable time after triggering during which the scope will not trigger again, even if the trace is finished. This blocks some erroneous trigger points, but it often doesn't work very well if there are lots of them within the signal. The solution is to use a separate connection to some other part of the circuit which has a reliable signal for triggering. Most scopes make it possible by providing an external trigger jack and switch. Naturally, the signal you pick to provide your trigger must be synchronous with the one you want to view or you'll just get a mess on the screen. Luckily, many devices deliberately or incidentally provide such signals. In fact, the alignment instructions for many kinds of gear tell you where to find them.

Faster—No, Slower

Once you've got your waveform frozen on the screen, you can decide what to do with it. Here's where the sweep speed control comes into play. Calibrated in TIME/DIV, this control simply sets how long it takes for the beam to sweep across the screen. Set it faster and the waveform stretches out. Set it slower and it all squeezes together. Like the vertical amplitude control, it has a variable knob which must be set to its calibrated position for the marked times to be correct.

The calibration refers to the divisions, or boxes, on the graticule. If you set the knob to 2 ms per division, it will take 2 milliseconds for each box to be swept. Knowing that speed lets you do rough frequency measurements; just divide 1 by the sweep speed. Let's try it: You're looking at a sine wave which repeats every 2.5 boxes. (It really doesn't matter which point on the wave you pick as your starting point, as long as you pick the same one for the next cycle.) Your sweep speed is 2 ms/div. To find the frequency in Hz, just multiply 2 ms times 2.5, which gives you 5 ms (the time period of your waveform). Now, divide 1 over 5 ms, and you get 200 Hz. Of course, this method doesn't have the precision or accuracy of a frequency counter, but it does allow you to figure out the frequencies of intricate signals, including those buried within other signals, which is something no frequency counter can do.

Well, we're getting near the end of our oscilloscope tour, but there's still a bit more and I've run out of space, so we'll have to finish up next time. Until then, 73 de KB1UM.

HAM HELP

Number 24 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. You may also upload a listing as E-mail to Sysop, to the 73 BBS/Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

My antennas (VHF and HF) are installed at the top of a building, and to feed them I need 37 meters of coax cable. Presently there are two cables of thin coax. I am losing almost half of my power. I want to feed both antennas with only one coax RG8 and have a relay near the top to connect the antenna in use; or, match both antennas with coax cable. I need information on how to do this. Thank you for your help. Dawid Wahrsager PY1MV, Rua Santa Clara, 431 - Bloco 2 - Apt. 402, Copacabana, 22041-010 - Rio de Janeiro, R.J.

Wanted: Sony CRF 320/330; Panasonic RF 9000; Philips D 2999; Zenith Transoceanic, and the relative literature for each. Please advise regarding conditions and prices, including air mail costs. Send to Sabino FINA, via Cesinali 80, 83042 ATRIPALDA, Avellino Italy.

Wanted: Service Information or source for same, for automobile digital instrument clusters. Bill Molenhauer N2FZ, 136 Cedar Ave., Pitman NJ 08071.

Unemployed, newly licensed, Caribbean Ham seeking goodwill donation of ham equipment and related items. If it works I'll take it. No items too big or too small. I will make minor repairs. Age and external appearance not a factor. Jerry Aberdeen J39DF, Westerhall, St. David's, Grenada.

Needed: A pictorial guide and schematic for a Heath Kit Model HX-1681. I will pay for the copy and postage. George Therien KB1AHX, 20 Metcalf Ave., Centerdale RI 02911. Tel. (401) 354-6514.

Wanted: Manual or schematic for the Maverick Dual Power HF Amplifier. If you can help locate these items, please call Jim Hassen KB3ANX, (301) 422-1209.

Attention Hams: If you are using the Apple IIGS Computer for Packet, please write to me. Thank you. William J. Kerr, Sr. KA2KAN, RD3 Box 371, Everett PA 15537.

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Amie Johnson N1BAC
43 Old Homestead Hwy.
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Notes from FN42

This is another busy month with lots of great information. I'm sure that you would rather read about what is happening around the world rather than have me ask you to get involved. Instead, I will let our ambassadors tell you how they and others got involved.

We are lucky to have another ham step forward to let us know what is happening in his country. David Plett 3A2LZ has volunteered to keep us up-to-date on the happenings in the Principality of Monaco. I'm sure that you will enjoy his first of many submissions. 73—Amie N1BAC.

Roundup

Australia Downloaded from packet, WS10 @ W1EHD: IARU Region 3 Chairman David Rankin 9V1RH reports that Ron Henderson VK1RH, President of the Wireless Institute of Australia (WIA), has become a Silent Key. Ron died of cancer on April 26. He was an active operator and a good leader in administrative matters. His passing is mourned by amateurs worldwide, with condolences to his family, the WIA, and his many friends around the world.

Bangladesh From the Bangladesh Amateur Radio League (BARL) Bulletin: Finally, amateur radio activities from Bangladesh! S21A, Saif Shahid, the first licensed amateur radio station from Bangladesh, has now been on the air for more than six months and during that time he has made more than 5,000 contacts all over the world. Saif is active on 10, 15, 20, and 40 meters on voice and digital modes, including RTTY, AMTOR, and packet. Saif is also the president of BARL.

S21B, Nizam, is also regularly heard on 20 meters. He works mainly between 1300 and 1600 UTC on SSB and has made over 1,000 QSOs.

The BARL regular monthly meetings, the first Wednesday of the month, are becoming more and more popular. These monthly open forums are open to anyone who is interested in amateur radio and electronics.

Further information about BARL can be requested from BARL, GPO Box 3512, Dhaka, Bangladesh.

Kazakhstan Downloaded from packet, WB2DHY @ KC2FD: Beginning March 1, 1993, new call signs are being issued. They have

begun assigning a "UN" series of calls in several oblasts. This will continue throughout this year and all the "UL" series will be replaced. UL7 = UN7, RL7 = UN9, & UL8 = UN8. Kazakhstan is getting UN, UQ, and UP callsigns. UL calls will go to Uzbekistan.

Please make note of this information as more confusion will inevitably follow. I anticipate some serious frustration. 73 de Ed NT2X.

Sweden From the Sveriges Sändareamatörer (SSA) Awards Program: The SSA sponsors four different awards: Worked All Sweden Award (WASA), Heard All Sweden Award (HASA), Swedish Locator Award (SLA), and the Field Award. Both the WASA and HASA have classes and groups for HF, 144 MHz, 432 MHz, 1296 MHz, and satellite. The SLA will be issued to licensed radio amateurs for verified contacts made with the various Maidenhead locator squares in Sweden. All radio bands may be used and endorsements can be obtained for individual bands and modes. The Field Award will be issued to licensed radio amateurs for verified contacts with fields, as defined by the Maidenhead locator system. Endorsements will not be issued.

For further information contact: Sveriges Sändareamatörer, Östmarksgatan 43, S-123 42 Farsta, Sweden.

Ukraine Downloaded from packet, UB5LCV @ N8GTC.#CIN. IN.USA: The first Ukrainian International Hamfest, under the motto "Who is UB5?" will be held 21-22 August in Kharkov. The hamfest will include a Ukrainian Amateur Radio League (UARL) presentation, DXpedition reports, awards, contest information, a slide show, VCR tapes, and great cultural programs. Open forums will give everyone an opportunity to find out who we are.

Further information can be obtained from: Igor L. Zeldin UB5LCV, PO Box 4808, 310103 Kharkov, Ukraine; or, for those with packet: UB5LCV @ UB5LMJ. KHA.UKR.EU.

HONG KONG

Phil Weaver VS6CT
Flat 39C Two Park Towers
1 Kings Road
Hong Kong

Spring has arrived in Hong Kong after one of the coolest periods I can remember in 19 years here. It has also been one of the most disappointing periods of propagation that we have had since I first started operating amateur radio here in

1979. Periods of activity have been severely limited this winter by few openings and there hasn't been a lot of rare DX since last year's bonanza, when it seemed like we had new countries coming along every week, giving us more and more of that elusive Honor Roll status. I am one of the lucky ones! Having worked D, ET, FO, HKØ, SØ1, VP8, XE4, YA, ZA, 7ICENI/O, and 1SØ in the last 15 months, I have finally achieved Honor Roll status after 13 years of operating.

Fernando Nacedo Pinto, known when active a few years ago as CR9AK, is in the process of "folding his tent" in Macau to return to Portugal and retire, finally. He had planned to leave in December, and we managed to see him at the ELARCS Annual Dinner. A few days later a farewell party was held at the Yacht Club for his many friends from the many interests in which he participated, from motor racing to yachting to amateur radio. He is a fine example of someone who gave a lot to the hobby. Any ham was welcome in his home in Macau, and I remember doing two expeditions from "Fern's" house in the early '80s.

After nearly three years of negotiation and cooperation between the Telecommunications Authority and the amateur clubs in Hong Kong, we have just been advised that the New Amateur Radio License will be issued in the very near future, having been approved by the Executive Council last December. Considerable improvements, from the point of view of amateurs, have been introduced and many of the previous restrictions imposed have been relaxed. This is not the place to enumerate them all. Suffice it to say, I think we should be grateful to all the people who got themselves involved in this exercise and say "thank you one and all." A new credit-card-size operator's license will also be issued this year. This should overcome the difficulty of being stopped by the police when operating a handie-talkie on the street or if you have amateur radio in the car.

For those of you who are interested in visiting amateur radio festivals or expeditions (by whatever name) but cannot make it to the world's biggest, Dayton in Ohio, USA, I would like to draw your attention to the second biggest, which takes place each year in Tokyo Harumi district during the last weekend in August. I attended this festival once, in 1988, and thoroughly enjoyed it. We hope this year to have a group of Hong Kong amateurs to attend and if we can get a sizable group together, I am sure that we can get some interest in our visit from the JARL, who could probably lay on a party or two. If you want any further information about it, please give me a call at 887-6366.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel

[The following are a few small tidbits from Ron. More will be published next month.—Amie] For the first time, the "Open University" has instituted a correspondence course for the advanced amateur license—the Class "A."

Packet radio continues to grow in popularity. 4X1MJ in Beer Sheva has made available kits for building the Baycomm modem, which can be put together for a very low cost. With the freeware program, the PC-clone computer takes over the functions of a TNC so that the TNC, an often hard-to-find and expensive commodity, is not needed. In the Beer Sheva area, thanks to Danny's efforts, quite a few new, young hams have been seen on the packet 4XNet.

Congratulations are due to Shlomo 4X6LM, who has completed his first year of editing HAGAL, the IARC magazine. He instituted many changes in the magazine, making it bimonthly and chock-full of technical articles, ham news, and more. The printing and graphics, coupled with the contents, have put the magazine in the first line of the ham publications in the world.

The Holyland Certificate Grid-Square collecting has become a serious mania! Those desirous of the squares should check the following frequencies: 14.265 daily at 1300 UTC, as well as 21.320 and 28.565. Many mobiles are active, putting the rarer squares on the air, and interest is running high. Saturdays on 7.050 MHz, there's great activity with the locals getting in on the fun. For further info on the award, check the back issues of this newsletter.

MONACO

Daniel Plett 3A2LZ
B.P. 349
MC 98007
Monaco

3A . . . JN33RR . . . 44 degrees 44 minutes North, 7 degrees 25 minutes East . . . Monte Carlo . . . These are all representative of the Principality of Monaco. Famous for its casinos and images of royalty and richness, Monaco is also well-known by amateur radio operators as one of the smallest and most rare countries to contact. Monaco is indeed quite small, one square mile to be exact. However, within this small area, there are about 50 licensed amateur radio operators.

The Association des Radio-Amateurs de Monaco (ARM) is the national society and has 29 members. The society's meeting place is open each Saturday for members to pick up or send QSLs through the bureau, check out recent magazines

Continued on page 82

73 INTERNATIONAL

Continued from page 80

from other countries, or just catch up on the latest news.

Here are a few bits of information to help you learn more about some of the distinctions of amateur radio in Monaco. All 3A1 callsigns are VHF only, no-code licenses. 3A2 callsigns are for stations with full operating privileges. Probably the two major differences in Monaco are that there are no 6 meter privileges at all, and that the legal limit for all stations is 100 watts. Due to space restrictions, most stations have limited antennas too.

Comments and inquiries are welcome. We look forward to chatting with you on the air.

OKINAWA

David Cowhig J76CBQ/WA1LBP
AmCon Naha
FBU PSC 556, Box 840
FPO AP 96372-0840

The coming of New Year 1993 brought New Year's greetings lasting throughout the month of January on the Japanese ham bands. Akemashite omedeto gozaimasu! If you plan to visit Japan, be sure to write the International Section, JARL, Sugamo 1-14-2, Toshima-

ku, Tokyo 170 Japan, about two months before you go for an application form. Once JARL receives your application, they will translate it into Japanese and send it on to the Japanese telecommunications authorities. Your license will be ready in about two weeks. The JARL does a great job helping foreign hams who come to Japan. The Japanese use the 144-146 MHz band largely for FM simplex and packet (in kanji characters and kana as well as alphanumeric characters) while repeaters (all-tone access—here in Okinawa mostly 88.5 Hz) are found on the 430-440 MHz band. You may need to modify your "made for the US market" handie-talkie to transmit in this range by cutting the right wire (and not the wrong wire, like I did).

In Okinawa, where Japan's spring begins, spring is starting its long northward trek towards snow-bound Hokkaido. Nago in northern Okinawa is now celebrating its annual Cherry Blossom Festival. Five Japanese professional baseball teams as well as two others from Korea and Taiwan began spring training in early February.

During our two-week-long Chinese New Year's visit to my wife's family at Bamboo Mountain (Chushan) in central Taiwan, I visit-


ed ham operator Jan Yigong BV5BR in his ham radio store in nearby Douliu. Mr. Jan's five-bay 2 meter antenna makes his downtown ham store hard to miss. Mr. Jan told me that the lower age limit for hams is 18, that the ham exam is given only once a year, and that since there is only one class of ham license, passing the exam (which includes an English language test!) is difficult. I told Mr. Jan about the US multiple-grade ham radio licensing system in the USA and about the Springfield Estates Amateur Radio Club started by Keith and Luke KO4IQ Ward in Springfield, Virginia, to show how young people can play a big role in ham radio [See the ARRL Education Workshop Proceedings 1991 for the story of this club]. Mr. Jan would like to see these things for Taiwan, too, but revising the Taiwan ham regulations will have to wait until the Taiwan radio world settles down.

Taiwan hams have had permission to set up repeaters since January 1, 1993. Although Taiwan hams have the 2 meter assignment of 144-146 MHz, they cannot use the lower 500 kHz of the band until the police move off it, perhaps sometime during 1993. There are college ham clubs in Taiwan at


Chenggong University and at Tsinghua University in Hsinchu. Mr. Jan explained to me that in Taiwan, hams (numbering about 2,000) are called huotui (hams), while their unlicensed brethren, the 300,000 or so xiangchangzu (sausage tribe), wander at will through various frequencies (they like 141 MHz best), in and out of the ham bands. Ham radio equipment is freely available and affordable in Taiwan so hams end up being much in the minority on the VHF and UHF ham bands. The HF ham bands are, in practice as well as theory, mostly reserved for hams. Fishing boats from Taiwan and southern Asia are often heard on 27-29 MHz.

The Taiwanese have been allowed to use radio transmitters only since martial law ended three years ago. Before then the only radio rule was that you were absolutely not allowed to transmit or possess a radio transmitter. The opening up of radio makes necessary a complex set of regulations which are not yet in place, although the Legislative Yuan of the ROC Taiwan government will probably make some progress on this during 1993. Taiwan hams regularly contact and visit in person their ham friends in the Chinese mainland.


YAESU



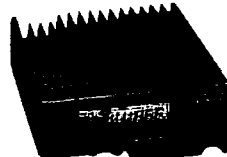
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FT-26, 2 Meter
FT-76, 440 MHz
FT-23R, 2 Meter
FT-33, 220 MHz
FT-470, 2M/440MHz




FT-2400
2 Meter Mobile




FT-212RH, 2 Meter
FT-712RH, 440MHz
FT-7400H, 440 MHz
FT-912RH, 1.2 GHz
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JULY 10

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& Computer Expo at the Charleston Ex-

JULY 11

nam Emergency and Amateur Rptr. League, will sponsor their annual "PEARLFEST" Hamfest and Fleamarket at Brewster High School on Foggintown

PITTSBURGH, PA The 8th annual Hamfest sponsored by the North Hills ARC, will be held from 8 AM-3 PM at the Northland Public Library, 300 Cumberland Rd. Talk-in on 147.09, the North Hills ARC Rptr. Get details from *Don Jackson N3LAZ, 8 Dale Ave., Bradford Woods PA 15015. Tel. (412) 935-3343.*

JULY 16-18

EAST GLACIER, MT The Glacier-Waterton Internat'l Hamfest will be held at Three Forks Campground, 16 miles west of East Glacier Park, on Highway #2. VE Exams. Contact *George Smith K7OD*, 1822 14th Ave. South, Great Falls MT, 59405. Tel. (406) 452-5958.

JULY 17

WELLINGTON, OH "NOARSFEST" (sponsored by the Northern Ohio ARS) will be held at the Lorain County Fairgrounds on Route 18, beginning at 8 AM. Contact *Dee Dee Ohman KABVTS, 4122 Bush Ave., Cleveland OH 44109. Tel. (216) 398-8858* between 6 PM and 11 PM EST weekdays; anytime on weekends.

JULY 18

WASHINGTON, MO The Zero Beaters ARC will hold its 31st annual Hamfest at the Bernie H. Hillenann Park (Washington Fairgrounds) from 6 AM-3 PM. VE exams at 10 AM. Contact *Ed Southall* WD0ELL, P.O. Box 24, Dutowow MO 63342. Tel. (314) 459-6581, or (314) 239-0060. Talk-in on 147.240+ rpt.

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JULY 24

GOWANDA, NY The 4th annual Swap 'N Shop, presented by the Tri-County ARS, will be held at Gowanda Firemans Grounds, Sand Hill (Rt. 62), beginning at 7 AM. Talk-in on 146.745 rptr. Contact *Andy K2ISN*, (716) 532-2250; or *Tom KD2EG*, (716) 532-5743.

LANCASTER, PA A Computer & Electronics Show will be sponsored by the Red Rose Repeater Assn., from 9 AM-3 PM, at McCaskey High School. Talk-in on 147.015/615. Contact *Wade Mackey*, 5 Sunrise Terrace, Millersville PA 17551. Tel. (717) 872-5328.

JULY 24-25

MANCHESTER, NH The New England Div. Convention will be sponsored by the New Hampshire ARA, and will be held at The Center of New Hampshire Conference Center, from 8 AM-4:30 PM. Walk-in VE Exams. Talk-in on 146.85- (wide area), 147.255+ and 223.9 (local). Contact *New Hampshire ARA*, P.O. Box 573, Derry NH 03038.

WOODLAND PARK, CO The Mountain ARC will hold its 12th annual Swapfest/Campout in the Colorado Rockies at Red Rocks Campground in the Pike Nat'l Forest (4 miles north of the city center on Hwy. 67). Campers: Advance reservations are a must. Talk-in on 146.82 rptr. Get details from *Bob*, (719) 687-9025; or *Fred or Patty*, (719) 687-9727. For reservations or info sheet, write *MARC*, Box 1012, Woodland Park CO 80863-1012.

JULY 25

BALTIMORE, MD The Baltimore Radio Amateur Television Soc. (BRATS) will hold its annual Maryland Hamfest and Computer Fest at the Timonium Fairgrounds. VE Exams will be given at 10 AM only. Pre-registration is required. Call *Les McClure W3GXT*, (410) 833-8667 to pre-register. Talk-in on 147.03 and 224.96 MHz rptrs. For info call (410) 467-4634, or write: *BRATS Hamfest*, P.O. Box 5915, Baltimore MD 21208.

JULY 30-31

MANISTIQUE, MI The "93" U.P. Hamfest will be held at the Schoolcraft County Fair Building, Sat., July 31st, 6 AM-5 PM. There will be a Fish Fry night. Contact *Debra K. Barton WB8IBT*, eves., (906) 341-5694; or write *M.A.R.A.*, P.O. Box 144, Manistique MI 49854.

JULY 30-AUG 1

REGINA, SASKATCHEWAN, CANADA Luther College at the University of Regina Campus will be the stage for "Regina Hamfest '93," sponsored by the Regina ARA. Address inquiries to: *Lyle Hopwood VE5HL*, @VE5AGA.SK.CAN. NOAM, 4530 3rd Ave., Regina Saskatchewan S4S 0E8, Canada.

AUG 1

SUGAR GROVE, IL The Fox River Radio League will hold a Hamfest at Waubesa Community College starting at 8 AM. VE Exams at 10 AM. Talk-in on 144.87/145.47. Contact *Bill Schaben*

WA9AUW, (708) 208-4870; or *Don Rasmussen N9III*, (800) 472-7826.

CROOKED LAKE, IN The annual Land of Lakes Angola Hamfest will be held at Steuben County 4-H Park, from 6 AM-1 PM. Talk-in on 147.180; packet 145.090; 444.350-131.8 tone; 224.94, 53.050. Contact *Land Of Lakes Angola Hamfest*, Sharon Brown WD9DSP, 905 W. Parkway Dr., Pleasant Lake IN 46779. Tel. (219) 475-5897.

SPECIAL EVENT STATIONS

JUNE 16-27

FT LAUDERDALE, FL N4PZN/MPS will operate from the manual-powered submarine races 1200Z-2400Z. Frequencies: SSB - 14.230, 21.300, 28.500; FM - 146.300 simplex; CW - 7.110. Sponsored by AUTC ARC, Andros, Bahamas.

JULY 4

THOMPSON, OH Station KD8FJ will operate (starting at 1400 UTC) from Heritage Hill Camp, in conjunction with the 7th "Heritage of Our Country" celebration. Operation will be in the lower portion of the 40m General phone band, and on 10m phone at 28.453 (if conditions allow). QSL with a large SASE to *KD8FJ*, 386 Cedarbrook Dr., Painesville OH 44077-2849.

JULY 8-11

WICHITA, KS The YLRL Convention will operate Station KB0FUN, on all bands, 1700Z July 8th thru 1600Z July

11th. QSL cards will be mailed to all stations worked.

JULY 9-11

NORTH DAKOTA, USA - MANITOBA, CANADA Station VE4IHF/0 will operate from the U.S. Lodge Internat'l Peace Garden during the Internat'l Hamfest. Frequencies: 3.937, 7.255, 14.255, 21.355, and 28.355. QSL with an SASE and a IRC or a green stamp, to *John Swanke KA0SLI*, Box 304, Lakota ND 58344.

JULY 10

CAPE VINCENT, NY The Jefferson County RAC will operate N2JOA 1200Z-2400Z to celebrate the 25th Annual French Festival, commemorating our French heritage in Northern New York State. Operation will be in the lower General CW and SSB portion on 80m, 40m, 20m, and 15m, and the lower Novice CW and SSB portions on 10m. For a certificate, send QSL and SASE to *JCRAC*, P.O. Box 523, Brownville NY 13615.

ENDICOTT, NY Station KB2JZG will operate from 1300Z-1900Z, (in conjunction with a M1 Rifle Clinic) to recognize the US Dept. of the Army, Office of the Dir. of Civilian Marksmanship programs for firearms competence. Operation will be in the lower portions of the General 40m, 20m, and 10m phone subbands. For a certificate, send QSL and SASE to *M1 Special Event*, P.O. Box 572 Union Station, Endicott NY 13760.

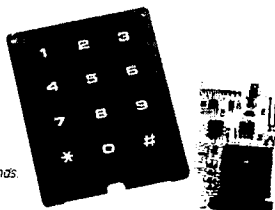
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JULY 10-11

FULTON, NY The Oswego County AR Emergency Service (ARES), will operate KY2F 1200Z-2100Z, each day, from the Central NY Internat'l Air Show at the Oswego County Airport. Operation will be in the middle of the General 80m, 40m, 20m, 15m, and 10m phone bands; the Novice portion of 10m; 147.75/15 MHz; and packet on 144.91 MHz. For a certificate, send your QSL card and a large SASE to *Fred Swialowski KY2F, P.O. Box 5227, Oswego NY 13126*.

U.S./CANADA Amateurs affiliated with the American Sunbathing Assn, The Naturist Soc., and the Federation of Canadian Naturists, will be celebrating National Nude Weekend by operating a series of Special Event Stations at nudist parks and nude beach sites across the U.S. and Canada. Operation will be from 10 AM-3 PM local time on 40-2m. For a certificate, indicate all sites worked and send QSL(s) with a 9 x 12 SASE to *Naturist Society Amateur Radio SIG, Box 74A Ash Rd., Coatsville PA 19320*.

JULY 11

TATAMY, PA Tatamy PA will celebrate its 100th Anniversary, and will operate KA3OEG from 1400Z-2000Z as a part of the Centennial celebration. Frequencies: 3.965, 7.2675, 14.265, 21.365, 28.365. To get a certificate, send QSL info and a SASE to *KA3OEG, Box 193, Tatamy PA 18085*.

JULY 17

BATH, NY The Keuka Lake ARA, Inc., will operate AA2CJ, 1300Z-2400Z to commemorate Living History Day, as part of the Town of Bath's 200th Anniversary. Frequencies: CW - 3700, 7125, 28200; phone - 3875, 7240, 14250, 28400. For a certificate, send QSL and a 9 x 12 SASE to *Reginald Gehret N2MAH, 125 E. Washington, Bath NY 14810*.

JULY 17-18

STRATFORD, NY The Fulton County Historical Soc. will operate W2ZZJ 1400Z-2000Z, July 17th and 18th, to celebrate the 167th anniversary of the birth of Dr. Mahlon Loomis, the American wireless telegraphy pioneer, who was born at nearby Oppenheim. For a certificate, send QSL, contact #, and a #10 SASE ONLY to *W2ZZJ, HC Box 80, Stratford NY 13470*.

JULY 24-25

PORT HURON, MI The Eastern Michigan ARC will operate K8EPV 1400Z Jul 24-0200 Jul 25; 1400Z Jul 25; and 1400Z-0200Z Jul 26, to commemorate the 68th Port Huron to Macinac Island Yacht Race. Frequencies: CW - 3.710, 7.110, 21.110; SSB - 3.910, 7.262, 14.262, 21.312, 28.393. For a unique certificate, send QSL and 9 x 12 SASE to *K8EPV, 1640 Henry St., Port Huron MI 48060*.

PORT ORCHARD, WA Kitsap County ARES will operate AA7LP from 1700Z on July 24-0300Z July 25 (0900-2000

July 24 PDT) to celebrate the 20th anniversary of Silverdale Whaling Days. Operations will be on 28.330 MHz (USB) and 147.510 MHz (FM simplex). For a QSL card, send your QSL and an SASE to *Matt Amis AA7LP, 2196 California Ave. E, Port Orchard WA 98366*.

JULY 26-AUG 1

CANTON, OH The Canton ARC will operate Station W8AL (1000 UTC-0200 UTC) to celebrate the Pro Football Hall of Fame Greatest Weekend. Frequencies: SSB - 28.350, 24.950, 21.350, 18.150, 14.270, 7.270, and 3.870 MHz; CW - 28.125, 24.910, 21.125, 18.080, 14.050, 10.120, 7.125, and 3.700 +/- QRM. There will also be RTTY, packet, AMTOR, satellite, and 2-meter FM/SSB. SWLs are welcome. For an unfolded certificate, send your QSL with contact number and a 9 x 12 SASE, with two units of first-class postage. For a QSL or a folded certificate, send your QSL with contact number and a #10 (business size) SASE to *Randy Phelps KD8JN, 1226 Delverne Ave. SW, Canton OH 44710-1306*.

JULY 30-AUG 1

WIESBADEN, GERMANY CQ de Frankensteini! The Wiesbaden ARC will operate Station DA1WA from 2000 UTC July 30-1200 UTC Aug. 1, on 80-10m in SSB, CW, and digital modes, from the famous castle near Darmstadt, during their 4th annual Castle Frankenstein DX-pedition. QSL via the bureau or direct with two or three IRCs or "Green-

stamps" to *Robert Kipp DJ0PU, HugelstraBe 25, D-6070 Langen, Germany*.

JULY 30-AUG 8

MIDDLETOWN, OH The Dial ARC will operate club station W8BLV from the National Hot Air Balloon Championships, evenings and weekends. Frequencies: SSB - 3.965, 7.265, 14.265, 21.365, 28.365 and 2 meters. CW - 10 kHz from the bottom of Novice bands. For a special balloon QSL, send your QSL and a SASE to *Ernest Howard AG8Y, 4003 Lewis Street, Middletown OH 45044*.

AUG 2-8

GRAND HAVEN, MI Members of the North Ottawa ARC will operate K8AR 1200Z-2100Z Aug. 2-8, to commemorate the 203rd Anniversary of the U.S. Coast Guard from Coast Guard City USA. Operation will be in the bottom portion of the General phone subbands. For a certificate, send QSL card and a 9 x 12 SASE to *NOARC, P.O. Box 44, Ferrysburg MI 49049*.

AUG 12-14

GLENS FERRY, ID The Southern Idaho Hams will operate K7QQP to celebrate the Three Island crossing of the Oregon Trail. Operation will be on SSB - 75m, 40m, 20m 15m General portion; 10m Novice/Tech portion, Thurs. 1800Z-Sun. 0600Z, or as long as conditions last. For a 3 x 6 card, send your QSL card and an SASE to *Paul KB7QHH, 5107 Grover, Boise ID 83705*.

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NEVER SAY DIE

Continued from page 4

Data Communications

It's one thing to be able to talk and another to find out what to talk about. I'd like to see some sort of system where I could get a dump of subjects of interest to the chap I'm talking with. My computer would highlight anything of mutual interest, giving us an edge in starting a conversation of interest to both of us. We should be able to dump something like that in a couple of seconds. Work on it, okay?

Yes, I know we aren't permitted to mix packet and voice on the same frequencies, so we'll need to get some Special Temporary Authority (STA) permits to develop these multimode communications systems. You shouldn't have any problem getting the permits.

A New Day Dawning

If we can pull this off I believe this could completely revolutionize the amateur service. We'll be able to really build some international friendships. Special interest nets will start growing around certain frequencies. For the first time we'll be able to actually talk with each other instead of lecturing.

It's going to be a lot easier to get kids interested in hamming. We may even be able to get our growth rate back where it was 30 years ago!

We've got 100,000 ham channels sitting unused just on 10 GHz, so we could use a few more hams.

With our being able to talk in groups sharing channels we'll be able to handle substantially more operators on our HF bands. We may have to insist that the ARRL shelve its confounded DXCC award so operators in rare countries aren't swamped with walpaper hunters.

I would never say it, but there are those who claim that country hunters are trying to compensate for inferiority complexes. There are thousands of addicted ops who will fight the pile-ups for hours to get a five-second signal report from some damned rock sticking out of the ocean. I'd like to see their explanations to St. Peter about this silly waste of a life.

How Was Dayton?

Well, I had a good time . . . how about you? Oh, it was crowded. No, it was far beyond being crowded . . . it was packed solid. On Saturday there wasn't any way to get around. The exhibits had people stacked two and three deep, which left almost no room for anyone trying to get through the aisles. I got around as best I could, jumping up near each booth to try and see over the crowd what was being exhibited. I'd hoped to pick up literature, meet the entrepreneurs, and ask a lot of questions, but getting close

enough to talk turned out to be difficult.

Yet many dealers were complaining that sales were way down from last year. I did see a lot of stuff being carried from the flea market to cars, but not much in the way of new gear going that way.

There was an industry meeting on Thursday evening . . . run by CQ magazine. It turned out to be mostly a promotion effort for a series of professional hamfests they're planning. They seem to feel there's big bucks to be made in hamfests. Maybe. I guess the thing that puts me off is that hamfests haven't seemed to change much in the 55 years since I attended my first. Well, maybe they don't need to.

One motivation for the commercializing of hamfests seemed to be the lack of any regular hamfests in Northern and Southern California. With over a hundred thousand hams in that area, obviously (they opined) it should be able to support two yearly hamfests. Having attended quite a few California hamfests, I'm skeptical. In case you haven't been out there, California hams are different. They have shown that they are able to stay away from hamfests in huge numbers. Perhaps whatever weird psychological forces drove these strange people to move to California doesn't encourage them to seek the comfort of crowds. They seem to be a bunch of individuals, with little of the lemming-drive of Eastern-

ers to pile up into large human masses such as we see at Dayton, Boxborough, Atlanta and other such hamfests.

Armed with what seemed to be an instant statistic that 41% of all ham gear is bought at hamfests, the CQ team is going to try and organize the hamfest business. What's the "Q" code for "good luck"?

I Lusted.

I saw an awful lot of new equipment that got my juices going. Great stuff. Wait'll you get a load of the stuff AEA has for you. They've got a great SWR gadget that plots the SWR vs. frequency for you. At \$400 it's a bit pricey for most hams, but what a great gadget for clubs to buy and share. Once you see it, if you ever want to have your antennas working at their best, you're going to have to get one of these killers.

And of course their new packet contraption does so much that they should have a 10-hour video training course just to get you familiar with what they've crammed into that little box.

There were some fabulous new linear amplifiers that would look great in my shack. And maybe it's time to decide which new rig to get, and what kind of an antenna will give me a monster signal on 20m.

Continued on page 88

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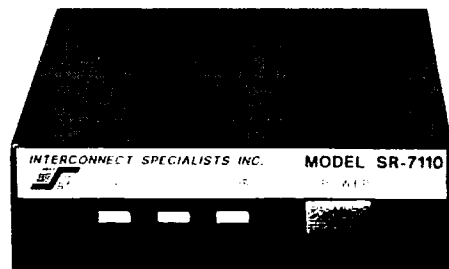


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NEVER SAY DIE

Continued from page 86

And I Talked, Too.

For two hours! And it was only Sherry pulling my sleeve, reminding me that we might miss our plane . . . and the increased signs of frustration of the AMSAT bunch, who had the next stint in the room, that stopped me. What did I talk about? Oh, all this stuff I've been writing in my editorials, in my *Declare War* book, and *Declare War Updates*. I talked about my sneaky plan to get everyone off simplex and into duplex operation . . . a move which we should have made 50 years ago.

I talked about EMFs and cancer. I talked about how our cells communicate. And ecoscams; the plight of IBM and what could be done to save the collapsing giant . . . if anyone thinks Big Blue is worth saving. I talked about our basis and purpose (97.1) being totally obsolete, the stupid proposed VAT, deluding NASA and the superconducting supercollider, how America can make money on foreign loans instead of just throwing it away, and so on.

Oh yes, I also mentioned a huge coincidence that I've recently discovered. You're probably going to disagree with my take on this, but I'll tell you anyway. I've noticed that there seem to be almost no well-educated poor people . . . and almost no poorly-educated rich people. Now, it struck me that this may not be entirely an accident. Could there be a correlation between education and success? And if there is, do you think this might be enough to convince kids that education really is important if they're interested in not being poor all their lives?

Of course they may prefer to play the odds that they'll become successful performers, athletes, politicians, or clergy, where an education isn't critical. At least for a while. Then, how many rich boxers are there? How many rich ballplayers? Dozens. And how many rich business people? Millions. But is that enough to get people to think?

The cold, wet, windy weather drove the flea market scavengers inside, making it even more difficult to move around. It finally got to where it was no longer possible to talk with exhibitors . . . I couldn't get near 'em . . . so Sherry and I headed back to crowd-free New Hampshire.

I did enjoy meeting a bunch of old friends. Not having a booth this time gave me a lot more freedom to get around. I wore a 73 hat so people could spot me, but I found that no one looked at hats. Too bad, because I had it all decorated with badges and buttons . . . my submarine combat pin from WWII, my Royal Jordanian Radio Society (JY8AA) pin, my Korean Amateur Radio League (HL9WG) pin, one from New Zealand, one from China, Russia, and one from Poland. My hat was decked out like a CBer's vest at a CB picnic. No one noticed. Heck,

I even had a little gold hand key, my Old Old Timer's Club pin, and my old Boy Scout pin from the '30s. I used to have some pins for winning ARRL contests, but some ex-employee mercifully swiped 'em. Yes, of course I had my ARRL 50-year pin on there, right up front. And one from Erasmus Hall High School. Well, what on earth else could I do with all that memorabilia? Waste of time. It was invisible. Phooey.

The post office has been putting out some postage stamp pins, so I put on the 5¢ ham stamp, ugly as it is . . . and a Scott Joplin stamp pin, promoting the five Greener Pastures Joplin CDs I've put out so far. I put on a skin diving pin, but couldn't find any of my skiing pins. Just as well.

So I'll put the hat, with all the pins on it, up in the attic, and go bareheaded at future hamfests. You had your chance to admire my collection and you muffed it . . . all 30,000 or so of you.

Ham of the Year!

I was delighted to see that the Hamvention Ham of the Year award went to Harry Dannals W2HD. Harry and I go way back.

The main reason for giving him this prestigious award was Harry's getting the QCWA to support the no-code proposal . . . a change of heart on his part which amazed me at the time. That's what I would have expected of Harry Gartsman W6ATC, the previous president, for whom I have a ton of respect, but Dannals has been so steadfastly pro-CW all of his life that I was certainly surprised.

I first ran into Harry when he ran for ARRL Hudson Division Director in the '50s. I think this was when he became a big Wayne Green fan. He's been talking about me at hamfests and over the air to anyone who will listen ever since. I understand that now that he's retired all he does is sit and talk on a Virginia repeater day and night, mostly about me. I count him as one of my number one fans.

Harry's big aim in life was to be an ARRL director. I think his father had been one and he wanted to prove to his father that he could do it too. I remember his father, a true CW fanatic. I remember him diligently jamming DX phone ops on the low end of 80m with endless CQs. This is still one of the more popular aspects of our hobby.

When I worked with Chet K2EAF on the 1960 ARRL National Convention in New York City, Harry was the president of the Hudson Amateur Radio Council, which sponsored the show. Harry came across to many people as a small-minded, fatuous, ARRL apparatchik. I was there when he was elected to that position by the newly formed Council. He managed this coup by outtalking everyone else, even though he didn't really have anything to say. No, I was not jealous. I was busy starting 73 at the time, so running HARC was not an option for me. Plus, I was the president of the Porsche Club of America. I was just

amused that the deciding factor in who was elected turned on who talked the most, and never mind what they had to say. I filed that away in my mind just in case something like that ever came up where I wanted to be a club president.

After Mort Kahn W2KR retired as Hudson Division director, Harry grabbed that job. It was Mort, a retired millionaire, who was the brains (a term which obviously I am using loosely) behind the ARRL's "Incentive Licensing" fiasco . . . by far the worst disaster in the history of the hobby. Harry, a devoted company man, rose to the presidency of the League. I attended several of his talks at conventions and found no reason to change my early opinion of him.

I always admired the League's ability to overlook their rules against directors working in the communications industry when it came to Harry, who worked in the communications department of an aviation company. I got the feeling that they invoked that rule only when someone was running for director who had not come up through the League traffic-handling system.

I saw no signs that Harry had shown any signs of initiative while ARRL president, so his turn-around with the QCWA was an eye-opener. The new Harry was a winner, so I'm delighted that he's been honored by the Hamvention. I've known most of their award winners . . . such as Bill Pasternak WA6ITF, who wrote for 73 for years. Heck, he helped me move the magazine from Brooklyn to New Hampshire back in 1962. Another winner was Carole Perry WB2MGP, who writes our Novice column, and has had a profound impact on our hobby.

We ought to have more awards for outstanding hams. Naturally my twisted mind suggests that we should have both good and bad awards. We ought to have some way to honor Herb KV4FZ for his yeoman work in erecting an outhouse over 14,313 and giving amateur radio its biggest-ever black eye. And a posthumous award to W2BIB for his great work in jamming medical emergency nets. And let's not forget K1MAN, the man who rains on our parade with endless self-promoting blind broadcasts.

The good guys, like John Williams W2BFD, who pioneered RTTY; and Sam Harris W1FZJ, who showed us what could be done with moonbounce and invented the parametric amplifier, got passed by. How about Bill Hoisington K1CLL, who got a whole generation building UHF equipment?

Now that Harry has turned against CW, will we see the QCWA promoting no-code Extra Class licenses? That'll increase Harry's esteem even more in my tired old eyes. And if you're ever near Virginia please look for Harry and find out why he's such a devoted fan of mine. He's on the repeater day and night, so you can't miss him. But I do wish he'd take off at least a hundred pounds so he'll live longer and

thus be able to spread the good old Wayne Green word longer.

Reflecting The Recession?

Despite the crowds, many exhibitors I talked with felt that attendance was down this year. And I was surprised to find some areas where there had been exhibitors in the past, but were now sitting empty and unused. Apparently the recession has hit amateur radio. Well, it isn't going to be anything like the disaster of 1964, when amateur radio sales dropped 85% in one year.

As I explained a few months ago, it wasn't the recession that caused 73 to not have a booth this year. We looked at the sales figures over the last few years and found that most of the Dayton bunch were already subscribers. We weren't picking up enough new subscribers to pay for the booth, shipping the exhibit, plus a couple people to handle it. And I found that having a booth kept me from seeing as much of the show as I wanted . . . crowds permitting.

I'll be interested to hear from any exhibitors on how the show went. Was it profitable? If you're not sure how you can tell, use the same yardstick as you would for any other promotion . . . did you sell at least 10 times the total cost of the show in merchandise? And that's if you're making at least a 10% net profit with your product. If you're making 20% net, then you can get away with only five times the cost of the convention in sales to break even.

If sales are really down, this may turn out to be a poor time for CQ to launch a series of commercial hamfests.

Review: Universal Time Piece

What kind of a crummy hamshack doesn't have a large clock on the wall? Pathetic! No wonder I get so many QSL cards with the wrong time on 'em. Nitwits. Lids. You want a nice big clock that'll keep accurate. Further, since this is your hamshack you don't want just any lousy big clock up there. You want to cream your visitors with a high-tech scientific clock . . . one that will have them asking questions you can smugly answer, but which they won't understand. It's the only way to run a hamshack. You are an electronic genius and they are morons, and remember that. But please be kindly in your condescension.

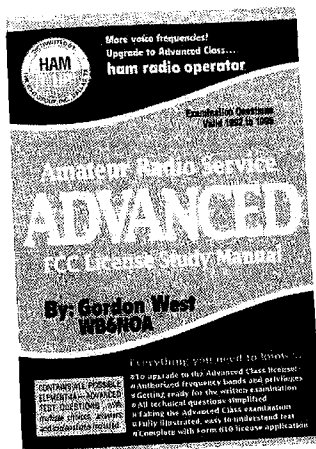
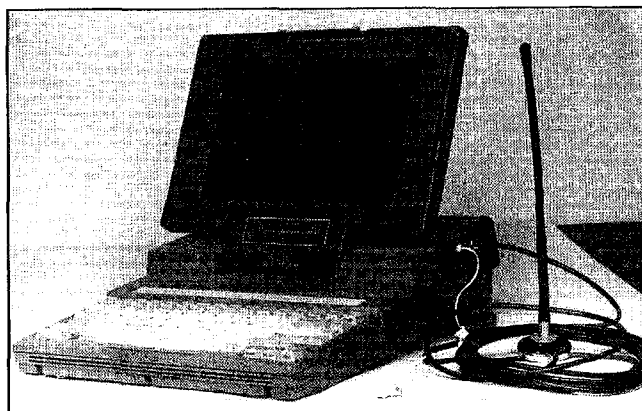
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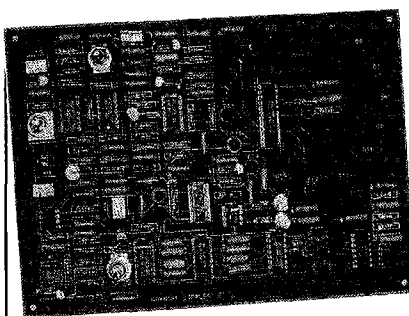
The Model ANB-1089 receiving processor provides any long-wave receiv-

MILESTONE TECHNOLOGIES

Milestone Technologies has released Milestone LOGMASTER II, an update of the popular ham radio and SWL log-keeping program for DOS computers. The new version represents a complete redesign, incorporating a lot of changes requested by our customers, especially in the areas of the user interface, performance, contest operation and reporting. Milestone LOGMASTER and the CODEMASTER Morse training application have been continuously upgraded since their initial release in 1985, and this upgrade takes advantage of the latest compiler, database and processor technology. User control of the program has been significantly enhanced and there is a completely new user interface which supports (but still

does not require) the use of a mouse. A completely reworked database design allows for the maintenance of multiple logs for special purposes, such as DXCC and contesting, and the number and size of logs is limited only by the available disk storage space. A key feature is ease-of-use: Anyone who can keep a paper log can use LOGMASTER straight out of the box.

LOGMASTER II is priced at \$29.95. Current users of LOGMASTER can upgrade for a nominal handling charge of \$10. For more information, contact **Milestone Technologies**, 3140 South Peoria St., Unit K-156, Aurora CO 80014-3155; telephone: (303) 752-3382. Or circle Reader Service No. 204.



DOUGLAS RF DEVICES

Douglas RF Devices has released a PC board and component kit for the Roanok Doppler DF Unit featured in *Transmitter Hunting—Radio Direction Finding Simplified* by KØOV and WB6UZZ. This unit offers the same

ease and flexibility of use as other systems costing 10 times as much. The Roanok Doppler DF Unit features a 16-LED circular indicator which provides 22.5 degree resolution which is quite adequate for mobile use. The kit comes ready-to-assemble, with over 95% of the entire project on the PC board and it can be assembled in about an hour.

The board and component kit sell for \$87.50 postpaid; *Transmitter Hunting* is \$19.95 plus \$2.90 shipping. Enclosure kits and antenna array kits will be released soon. California residents add sales tax. For more information, contact **Douglas RF Devices, P.O. Box 246925, Sacramento CA 95824-6925**; telephone: (916) 688-5647. Or circle Reader Service No. 206.

er with improved flexibility and reception capabilities. The ANB-1089 features: a selectable 20 dB gain preamplifier; a 15 kHz bandwidth filter; automatic noise blanking (threshold adjustable); adjustable IF shift; continuous coverage from 10 kHz to 450 kHz; and a connection for oscilloscope monitoring of noise blanking. It's ruggedly built, small, and portable.

The LF2A is \$155 ppd.; the recom-

mended collapsible 60" stainless steel antenna is \$13; and additional 25-foot interconnecting cables are \$6 each. The ANB-1089 is \$108.52. California residents must include sales tax. For more information, contact **Curry Communications**, 737 North Fairview Street, Burbank CA 91505; (818) 846-0617. Or circle Reader Service No. 207 for the Model LF2A; No. 208 for the Model ANB-1089.

David Cassidy N1GPH

First QSOs

Almost every ham has an elmer in his or her past. I had several, mostly the faculty advisors and other members of the Brockton (Massachusetts) High School Amateur Radio Club. Somewhere buried in a box are the high school yearbooks that contain the names and pictures of these elmers, but I can't for the life of me remember their names off the top of my head. Maybe I ought to dig out those old books.

I remember my very first QSO under my own call sign. It was with a station in Dallas, Texas, and I don't even have to look in my first logbook to tell you that it was on the 15 meter Novice band. My call sign at that time was WN1UIR, soon to be changed to WA1UIR when the FCC stopped giving Novices the special WN prefix. Since I was operating from a fellow radio club member's home station, I dutifully signed WA1UIR/1, as was required at the time.

Like probably hundreds of thousands of other first QSOs, mine was made on a Heathkit HW-16. For those of you who have never had the pleasure of a QSO on a HW-16, I pity you. To my 14-year-old eyes, it was the embodiment of wonder and adventure. It's dial lighting emitted a soothing glow in the dark, cool basement of my friend's house. The matching VFO allowed us access to the entire Novice HF frequency allocation.

My friend made a few contacts, and I copied along. Finally, he turned the straight key over to me and said, "Go ahead... give it a try." I tuned around and found an open spot and committed my first act of RF emission.

"CQ CQ CQ YQ CQ YQ DE WN1UIR..." Oh, no! What's a slash? OK, OK... I got it... "1 WN1UIR/1 WN1UIR/1 K..."

Almost immediately, I heard my very own call sign coming through the speaker of the HW-16 at approximately the same speed I had been sending, which was, of course, about three times the speed I could copy. I got as far as WA5, then froze. Luckily, my friend was copying along, and he quickly showed me the station's call sign circled on the top of his piece of paper. Phew!

I sent both call signs, then imitated the few QSOs I had watched my friend make. I sent my name, QTH and signal report. I also managed to say that it was my very first QSO, then sent "HW CPY?" and both call signs again. After the KN, I quickly grabbed my pencil, determined to show my friend that I had actually passed the Novice code test.

"FB DAVID—NAME HR IS BILL. BILL—QTH IS DALLAS DALLAS—UR RST RST IS..." Jeez, this is tiring! Ohmageddoo, I hate numbers! What was that? Did you get that? He's speeding up! Calm down... Calm Down!... CALM DOWN!! Forget about what you missed. Just start copying again.

"SB—SO BK TO YOU DAVID - WN1UIR/1 DE WA5..."

My friend quickly showed me his perfect copy, filling in the halt that I had

missed. My RST was 569, with QRM and QSB. What was that? Oh yeah... I remember... interference and fading. OK... my turn again. Gee, my hand hurts!

"... DE WN1UIR..." What was the slash? I forgot the slash! Oh, yeah, "... /1—FB BILL—SLD CPY HR—" Now what do I say? I have absolutely nothing to say to this guy. Maybe if I just shut the rig off he'll think I had a heart attack or something. Or maybe he'll spend the next few days fruitlessly calling WN1UIR/1, finally turning my call sign over to the FCC as a rude and shameless example of a bad amateur radio operator. I'll lose my license. I'll be fined... thrown in prison... my Dad will lose his job and my family will be ridiculed and scorned!

My friend saved me from this dreadful fate by suggesting, "Why don't you tell him what rig you're using, then tell him that you're operating from a friend's house? Since you're not in the *Calbook* yet, you could tell him you really want his QSL card, then send your address. Then, maybe mention the nice spring day we're having. Tell him how old you are, and that you got your license at your high school radio club."

Great ideas! I launched into a 10-minute monologue mentioning each and every one of these things. I always found it much easier to send CW than to receive, so I had no trouble banging away, though I lost my place a few times and I'm sure I misspelled a few words. After finishing my life's story, I turned to my friend and asked, "Now what do I do?" "How about letting him talk for a while," he helpfully suggested. Darn, that means I have to copy again. Oh well, I guess there's no way to avoid it. I sent the call signs and grabbed for my pencil.

There were at least three other CW signals coming through the speaker now, none of which I could copy. My friend said he had our station, pointed out which one of the CW signals was the WA5's, then we both struggled to copy the fading signal:

"... QSB... QSL OK... SAY 73 73 ES... AGN... DE WA5..."

Now what do I do? I didn't get any of that! I can't respond if I don't know what he said!

My friend calmly explained that my WA5 was saying good-bye, and that I should tell him that the QRM and QSB were getting worse, thank him for the QSO and say 73... which I did like an old pro (if I do say so myself).

That was it. My first QSO. I was officially an amateur radio operator. We looked up Bill's address in the *Calbook*, and I sent out my first QSL card, writing "Trx for my first QSO!" on the back. A week or so later, a glossy black QSL card with silver printing showed up in my mailbox.

Since that day, I've had thousands of contacts using many different modes. Most of them are just letters written in a logbook, but I'll always remember that first one... and the patience of my friend and that ham in Dallas.

A few years ago I had the privilege

Continued on page 62

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

The summer doldrums... you're probably tired of hearing that by now. July is not considered a particularly good month on the HF bands because of the high QRN levels and the high absorption of signals surrounding midday. However, short skip will prevail on some bands during daylight hours, and there will be reasonable DX in the mornings and afternoons (local time). Here's what you can expect for general conditions.

10 Meters/12 Meters

Some north/south DX paths open in the afternoon. Short skip out to 1,200-1,500 miles should be good on most days (calendar symbol "G," "G-F," "F-G").

15 and 17 Meters

There will be fairly good DX to countries below the equator during daylight hours (only on "Good" days), peaking during the afternoon. During the day, there will be good short-skip and sporadic E communications out to about 1,500 miles (for example, some east/west paths to Africa on "Good" days).

20 Meters

This is the DX band of choice during July, and worldwide DX can be expected on days marked "Good" (G) on your calendar. Best conditions during the day will be shortly after sunrise and shortly after sunset, although the band will stay open after dark. Excellent short-skip openings will take place throughout the day.

40 and 30 Meters

Evening, nighttime and early morning hours will provide DX on the "Good" (G) days. Around midnight the DX will be toward Europe; just before sunrise it will be toward Oceania and the Far East. Short skip will be excellent during daytime. As always, thunderstorm activity and high noise levels will dim the results on some days.

80 and 160 Meters

Neither band will show much

daytime activity because of the high absorption of signals. Nighttime DX will depend on atmospheric noise levels (QRN), but you can expect some DX on the "Good" (G) nights. Short-skip will prevail on 80 during the day and night, with nighttime short skip out to 2,000 miles or so. You can also find short skip out to 1,000 miles or so during the night on 160 meters.

Using the Calendar

The last week of the month is expected to be the worst for operating, with the 28th through the 31st being particularly poor. For best conditions look at the "Good" (G) days and for trends from "Fair to Good" (F-G). It is possible that severe weather and other geophysical phenomena will take place on or around the days marked "Poor" and "Very Poor." Batten down the hatches and be alert for warnings around the 28th-30th, the days marked "Poor" and "Very Poor."

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	-	-	-	-	-	-	-	-	-	-	-	-
ARGENTINA	-	-	-	-	-	-	-	-	-	-	-	-
AUSTRALIA	-	-	-	-	-	-	-	-	-	-	-	-
CANAL ZONE	-	-	-	-	-	-	-	-	-	-	-	-
ENGLAND	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII	-	-	-	-	-	-	-	-	-	-	-	-
INDIA	-	-	-	-	-	-	-	-	-	-	-	-
JAPAN	-	-	-	-	-	-	-	-	-	-	-	-
MEXICO	-	-	-	-	-	-	-	-	-	-	-	-
PHILIPPINES	-	-	-	-	-	-	-	-	-	-	-	-
PUERTO RICO	-	-	-	-	-	-	-	-	-	-	-	-
SOUTH AFRICA	-	-	-	-	-	-	-	-	-	-	-	-
U.S.S.R.	-	-	-	-	-	-	-	-	-	-	-	-
WEST COAST	-	-	-	-	-	-	-	-	-	-	-	-

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	-	-	-	-	-	-	-	-	-	-	-	-
ARGENTINA	-	-	-	-	-	-	-	-	-	-	-	-
AUSTRALIA	-	-	-	-	-	-	-	-	-	-	-	-
CANAL ZONE	-	-	-	-	-	-	-	-	-	-	-	-
ENGLAND	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII	-	-	-	-	-	-	-	-	-	-	-	-
INDIA	-	-	-	-	-	-	-	-	-	-	-	-
JAPAN	-	-	-	-	-	-	-	-	-	-	-	-
MEXICO	-	-	-	-	-	-	-	-	-	-	-	-
PHILIPPINES	-	-	-	-	-	-	-	-	-	-	-	-
PUERTO RICO	-	-	-	-	-	-	-	-	-	-	-	-
SOUTH AFRICA	-	-	-	-	-	-	-	-	-	-	-	-
U.S.S.R.	-	-	-	-	-	-	-	-	-	-	-	-

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	-	-	-	-	-	-	-	-	-	-	-	-
ARGENTINA	-	-	-	-	-	-	-	-	-	-	-	-
AUSTRALIA	-	-	-	-	-	-	-	-	-	-	-	-
CANAL ZONE	-	-	-	-	-	-	-	-	-	-	-	-
ENGLAND	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII	-	-	-	-	-	-	-	-	-	-	-	-
INDIA	-	-	-	-	-	-	-	-	-	-	-	-
JAPAN	-	-	-	-	-	-	-	-	-	-	-	-
MEXICO	-	-	-	-	-	-	-	-	-	-	-	-
PHILIPPINES	-	-	-	-	-	-	-	-	-	-	-	-
PUERTO RICO	-	-	-	-	-	-	-	-	-	-	-	-
SOUTH AFRICA	-	-	-	-	-	-	-	-	-	-	-	-
U.S.S.R.	-	-	-	-	-	-	-	-	-	-	-	-
EAST COAST	-	-	-	-	-	-	-	-	-	-	-	-

See Hertz's website on good days only

JULY 1993

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G	3 G-F
4 F-P	5 P	6 P-F	7 F-G	8 G	9 G-F	10 F
11 F-P	12 P	13 P-F	14 F	15 F-G	16 G	17 G
18 G	19 G	20 G	21 G-F	22 F	23 F-G	24 G
25 G	26 G-F	27 F-P	28 P-VP	29 VP	30 VP	31 VP-P

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A DECADE OF PACKET



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NEVER SAY DIE

Wayne Green W2NSD/1



The Ugly Americans

No, we don't have a complete lack on being ugly, but we sure are way out ahead of whoever is in second place. Our recent and successful effort to chase His Majesty King Hussein JY1, the most famous ham in the world, off our bands with catcalls and name-calling is one of which all Americans can be proud. We can also point with pride to our continuing stupidity on 14.313.

One does not have to visit very many countries to find out what kind of reputation Americans have. The lack of consideration we exhibit in chasing DX is something they see in most American tourists, too. They claim we make up in arrogance what we lack in education and culture.

We tend to come across as unintelligent, but it isn't that. I'm convinced it's our educational system. Indeed, if you've taken the time to find out about IQ and IQ tests you know that (a) Asians have a several-point lead on whites in IQ, and that (b) American blacks tend to have a 15-point lag. You also know that (c) few journalists have bothered to learn the well-documented facts before writing on this emotionally-charged subject.

Alas, there's far too little correlation between having brains and using them. A computer is pretty useless when some of the keys are out of action and the programs have too little data with which to work. Well, the same goes for our brains. If we load them down with garbage, it's the old computer cliché: garbage in = garbage out.

So here we are with an educational system dumping garbage into little minds. We make up for that by virtually cutting off all intelligent communication with our kids, trusting them to learn how to interact with people via what they're watching on TV. Perhaps we deserve what we get.

No, I don't agree with King Hussein's support of Saddam. But I understand the fix he's in, with a large part of his people being Palestinians and being sucked in by Saddam's propaganda . . . plus a bunch of wishful thinking. I doubt any of us would have done as well as His Majesty under the circumstances. He's treading a tightrope over a tinder box, to coin a combo-cliché.

Of course, I'm critical of HM's getting into this fix. I think he could have avoided it. He's in trouble for the same reason we are . . . he's allowed a really terrible educational system to develop. I know you're going to find this difficult to believe, but Jordanian kids are even stupider than American kids, and it's got nothing to do with their basic intelli-

gence. Our kids come out next to the worst in surveys. Only the Jordanian kids have managed to beat us out of last place in international comparison tests.

His Majesty has done a lot of good things for Jordan. But he's been so involved with Mideast politics that he's let some very important things slip through the cracks. In addition to re-inventing the Jordanian educational system, he also needs to put some effort into eliminating graft as a means of getting rich and put more emphasis on rewarding people who are working hard to improve the business climate.

He had a wonderful opportunity to provide leadership and help to the Palestinians in Israel by providing educational programs in Arabic on his TV stations and beaming 'em into nearby Israel. During the Intifada the Israelis closed the Palestinian schools. This seemed like a really dumb approach. It's ignorance that's the main enemy in that part of the world. About the only benefit to ignorance anywhere is the ability it provides to those with an education to take advantage of the ignorant.

Jordan has no natural resources of value, only its people. Thus, the more His Majesty invests in his people's education, the richer his country will be, and the better the legacy he will leave.

Several years ago I tried to convince HM of this, pointing out the potential Jordan had to become the educational center for the whole Arab world. Once they started broadcasting educational programs on TV they could also package them on videotape and easily repay the production costs. What courses? I had in mind everything from preschool on through to Ph.D. graduate courses. I had in mind courses helping people to learn special skills. Engineering, architecture, business, ecology, nutrition, astronomy, medicine, and so on. No, many of these won't eliminate the need for a live teacher, but they would make it possible for live teachers to reach a much wider range of pupils.

This approach to teaching will even work well with cooperative learning, where students work in teams and teachers are cheerleaders instead of instructors. This is a relatively new approach to teaching which is winning converts all around the world. I cover this in my book (*Declare War*), so I won't go into detail here on how it works.

What Can We Do?

The first step is to throw some light

on the jerks who are devoting their lives to ruining our hobby. This means we need to get good at locating these ham terrorists. The FCC has some very sophisticated direction finding equipment these days, so I'd love to see some articles on how we can build what it takes to find these jerks.

I've already explained in the past how we can identify any individual transmitter just by its characteristics. Every rig has a slightly different fingerprint. All you do is record it and expand the starting edge of a transmission and you'll see that no two are precisely the same. We need some articles on this technology. As far as I know this stuff isn't classified, so let's see some articles.

Once we find out who these jerks are we can throw the spotlight on them and watch them scurry for cover, like the stinking roaches they are.

What better activity for a radio club than helping to clean up our hobby? We're supposed to be self-policing, so let's get our act together and deliver on our promise and stop calling the FCC and whining every time we have problems.

We can clean out 14.313 in short order if we really want to. And ditto any other festering sores that boil up.

If You Hear HM . . .

Tell him Wayne will be glad to come over and help get his educational system out of the cellar. I haven't visited Jordan in years, so it's about time I wandered over that way. Jordan is ideally located to help eventually solve the Israeli-Arab mess, as well as to stop the move to Muslim fundamentalism which is even a greater danger in the long run. All of these problems can be solved with education. But then, that holds for all the rest of the world's problems, too. Including ours.

There's no other investment that pays off nearly as well as one in education.

Is It Time To Change?

A letter from Brent Putnam N8UBD asking about combining the Novice and Tech licenses got me to thinking . . . always a bad sign. Now I know you are perfectly happy with the Novice, two kinds of Tech, the General, Advanced, and Extra Classes of license. And I know you really hate change. So what I'm going to discuss you're probably going to hate. Worse, I'm going to ask you to actually . . . gasp . . . think! Yes, I'm being sarcastic, thereby offending the half of you who actually do enjoy thinking, and at the same time offend-

ing the other half who find the whole concept of thinking alien.

I like to tackle problems by going back to basics and forgetting whatever Byzantine things have evolved so far. In the case of our amateur licenses let's first think about what the purpose is of having licenses. Do we need 'em?

I remember when I posed this question to the FCC about CB licenses. It had never occurred to them not to license CBers, so they were spending millions doing it. I asked them why. They didn't have any good answers other than they'd always licensed transmitters. And maybe the fact that there was a license would tend to make CBers obey the rules. Har-de-har. It took awhile for my reasoning to break through the bureaucratic minds, but eventually they gave up on issuing CB licenses. The sky did not fall. Saged a little maybe.

Okay, what purpose does a ham license serve in 1993? Well, let's start with the exam . . . what purpose does it serve? Perhaps we can start by asking what do we really need to know to operate? I'd go back one more step in the obvious questioning and ask what is the purpose of the Amateur Radio "Service" in 1993, except that the answer would just tend to embarrass us and might, if the concept ever penetrated the government, lead to some unpleasant consequences.

Let's pretend that we're still able to fulfill some of our original responsibilities. Let's pretend that we are still paying our way in exchange for billions of dollars in precious frequencies. It's been a generation since we invented or pioneered any new modes, so we can scratch that one. The military hasn't called on us in time of war for 50 years, so we can scratch that one. International friendships? Nope, scratch that one too. We have few friends. We're Ugly Americans on the air. Okay, we are still around in emergencies, so that's something. Of course our traffic nets are hardly beyond smoke-signal speeds when it comes to throughput in this day of 9600 baud.

The technical part of our exam is geared to the days when we built and serviced our own equipment. These days we haven't a clue as to what is inside, much less have the test equipment and experience to try and fix it. What real purpose does the technical exam play these days?

Old-timers will remember back to 1963 when the ARRL proposed what was amusingly called Incentive Licensing. This was a proposal that everyone have to retake a technical exam before they could continue to operate on phone on any bands between 160m and 10m. This scared the living hell out of everyone. Take the exam again? No way! Tens of thousands of hams put their ham gear up for sale for anything they could get for it. This killed the market for new equipment so totally that ham industry sales dropped by 85% in 1964. This, in turn, forced 85% of the ham dealers out of business, as well as virtually all of the manufacturers. Within a couple years we'd lost over 700 ham stores, plus Hallicrafters, Hammarlund, National Radio, Millen, EF Johnson, Barker & Williamson, Central Electronics, Gonset, Sidelband Engineers, Multi-Elimac, Harvey-Wells, Lakeshore Industries, Thordarsoon, Stancor, Eldico, and so on. Collins hung in there, but stopped all further product development, and

Continued on page 84

From The Hamshack

Ted Brattstrom NH6YK, Honolulu HI Wayne, in your eternal challenge to get hams off their rear ends and doing something new, I figured that I'd let you know what I've been up to in the two years since I received my license:

"Contacted" 106 DXCC countries on 10 meters (60 confirmed).

Had great conversations with a number of people, some of which I have even spoken to more than once!

Spent a lot of time playing with 10 meter SSB.

Had chats with U5MIR, U6MIR, and KB5SIW, using an HT and either a 5/8 whip on the car or a three-element hand-held beam. (Hawaii and Midway are great for this—there are few hams and not many of them are into satellites.)

Used the U5MIR-1 BBS to send messages to people and vice versa.

Set up and run TCP/IP on packet. Demonstrated amateur radio to two educational technology conferences.

Helped six of my students get their ham licenses (mixed success here—I left that school and few of them have used their privileges).

Operated as NH6YK/ZL on 2m and 70cm in New Zealand. They have a brilliant rule there that states: If you are a legal amateur and authorized at home on VHF and have your license with you, you may operate 2 meters and above for up to four weeks without filling out a form! Merely use your call and append portable ZL. Wouldn't it be great if we had that rule?

Operated NH6YK/KH4 when I spent seven weeks on Midway atoll last summer. Although I operated only 10 meters and 6 meters (a couple of CW contacts each on 15, 40, 80), I made over 800 contacts. Except on 6 meters, a contact usually lasted long enough to tell people a little about the island and what I was doing there. I was a volunteer for the Fish and Wildlife Service, playing with gooney birds.

Learned (and am learning) about 6 meters. From Hawaii it is ALL DX, and fascinating. I had a borrowed 6 meter radio and antenna on Midway and contacted five "countries." That was fascinating. On Midway I used 100 watts; here at home I use only 2 watts, either into a dipole (at home) or a borrowed four-element quad (at school). Amazingly, I've worked VK4, VK7, FK8, T30, V73, JR6, VR6 and KH6 with that power. One time I used my 10m half-square antenna as the 6m antenna. It worked! One nice thing about 6 is that people are very willing to help the neophyte.

Went on a Kalawao County DXpedition. A small troupe of us flew over and set up for the weekend. Since there are no active hams in the county, a former/current Hansen's disease colony, this was a relatively sought-after contact by some. I got to make my first AO-

13 contacts there. That was a lot of fun, and brought back the days I was station manager/operator for PEACESAT in American Samoa and using ATS-3.

I'm just starting to play with AO-21. I've now managed to pick up the digital recording, and I'm going to have to plug the TNC back into the computer and see if I can decode the packet! I'll try again tonight to make a voice contact on it with the 70cm up/2m down.

What's on the frontier for me: upgrade—get the code out of the way and gain access to those other frequencies; get more of my students licensed and operating; work on some radio astronomy; find some money or scrounge an ATV system; likewise, satellites.

I'll be operating in V31 and TI this summer, probably just 6m and 2m FM, unless I can convince the YL (also licensed) that a small 10m rig is reasonable amongst the cameras and scuba gear, and hopefully the E6B and charts so I can do a little flying also.

So, I try to keep up on the radio side of things. Oh, my real work is as a chemistry teacher at Pearl City High School.

Wayne, keep it up. If nothing more, you get people stirred up enough to do something. *Radio Fun* and *73* are great.

J. A. Fontana VE3MJF, Ottawa, Canada I'm a recently licensed ham (18 months) and have been alternately buying *73* and the "other" magazine off the rack, trying to make up my mind. This month I decided on and subscribed to *73*. I think, overall, that it has more that the "little guy" can relate to and it is not as esoteric as the other one.

I enjoy your editorials. I'd like to see a monthly "For the Sake of Argument" column in which you invite your readers to comment on something about the sport that troubles them, or needs fixin', or whatever. Something stimulating.

Good idea! . . . Wayne

Guy DeMarco N2LWL, San Diego CA I voraciously read your magazine from cover to cover. You seem to be able to print some of the most buildable (and usable) projects. Your department columns are top-notch.

But . . . (I'm sure you saw this coming!) I do have a gripe. I am an Avionics Technician in the Navy. I'm a bit put off by Wayne's moaning that us enlisted-type electronics specialists are "not what we used to be." I am finishing up my engineering degree in electronics and am an avid ham and teacher of electronics. While there are bad technicians who cannot read a schematic, please don't classify those of us who are proud of our accomplishments with the complacent service

members. There's always *one* bad presidential candidate. *One* does not prejudice all.

Yes, I'm a club officer, an Elmer, a teacher and a happy and challenged ham. Yes, I'm a college student and a defender of our constitution. Therefore, please do not toss out anecdotes about how awful the Navy technicians are. I'm sure didn't mean to stereotype us, but I'd be reassured if you could keep this in mind.

Tom Bowes KB8NDS, Richmond MI Wayne, I wanted to write to tell you how much I have been enjoying *73 Magazine* and the ham radio hobby I discovered about a year and a half ago. I look forward to picking up a copy of *73* each month and, of course, the first thing I turn to is your column. I find that I agree with you most of the time (pretty scary), and it is partly because of your input that I have continued to expand my knowledge by getting into computers and packet radio. The only thing I can't figure out is why your remarks seem to cause such a violent, knee-jerk reaction in some people. It is as if they were indignant that anyone should awaken them from the stupor of snoozing in front of the TV.

I caught your presentation at Dayton and found it thoroughly enlightening and thought-provoking. I agree with you wholeheartedly about our alleged emergency service role and its overall lack of efficiency. I participated in my first RACES exercise last fall and was immediately convinced that there had to be a better way. One month later I bought a TNC, a \$10 dumb terminal and a secondhand 2 meter rig and voilà, I became a packeteer. Now all I have to do is convince our local RACES group to really get serious about developing an effective packet network. You have mentioned the ridiculous nature of the CW traffic-handling nets. I'll add to that by mentioning the ridiculous nature of the phone-traffic-handling nets. All this "Would you please repeat, I didn't get the right count" and "Sorry, I couldn't copy you because somebody doubled" stuff has got to go. It's no wonder most amateurs aren't involved in emergency communications. The speed of most NTS and emergency phone nets reminds me of when I was a kid playing my 78 rpm records on the 33 speed. Things just go soooooo . . . slooooo. I couldn't take enough No-Doz to deal with the pace of most nets.

While at Dayton I spent some time lobbying the major radio manufacturers with my idea of how they could improve their products and help out the amateur radio operator's emergency service role. What I am proposing is that they incorporate into the design of every radio a separate packet port on the rear of the radio. This port would be configured with the same pin configuration for every radio manufacturer, and eventually for every TNC. The radio would also be programmable to allow disabling of the microphone and speaker audio during digital operation. It would also allow the packet port to be disabled

when on a phone frequency preset. This feature would help to eliminate the problem of those who forget to turn off their TNC when changing frequency and consequently end up transmitting packet tones on a phone frequency and consequently end up transmitting packet tones on a phone frequency. It would also allow one to work packet without having to find a way to eliminate the annoying "brap-brap" of the rig's speaker.

My reason for proposing a standardized port configuration is that I have heard of too many instances where an emergency packet station has been rendered inoperative because the radio failed. While there were other radios available for use, none could be used because of the lack of a proper interface cable. By having all rigs configured the same way we could increase our flexibility in an emergency situation. My proposed data port configuration would be the venerable 9- (or 15-) pin female D-sub connection. Think of it—the cables would be inexpensive (about three bucks), widely available, and by the virtue of the thumbscrews on the cable hood they couldn't pull out of the back of the rig as my DIN connector is so fond of doing. Now, I realize that all this practicality would likely cost our beloved radio manufacturers some revenue due to the lost sales of adapters and specialty connectors, but I am convinced that they could probably come up with some other scheme to get our hard-earned dollars.

In addition, all of these radios would be set up for 9600 baud operation right out of the box, without the additional hassle of modifications. I would also like dual-band rigs to come with the ability to run packet via the data port on one band, while being able to simultaneously accommodate phone operation on the other band via the microphone jack and internal speaker. Or . . . the dual-band rig would be able to run packet on both bands at the same time and would be interactive with the TNC, via one of the data connector's pins, to allow remote operation of a digital crossband mode while using only one TNC. There would also be a +13.8 volt terminal built into the connector in order to eliminate the need for a separate power supply for the TNC. Although it may sound like I have my head in the clouds with this radio design wish list, there is really no reason why all of these features could not be incorporated into a rig with the technology that is now available.

The reason that I am writing to you, Wayne, is to enlist your support for these design goals for our radio gear. It is my hope that by incorporating these improvements into our radios, more operators will be encouraged to get into digital modes. Hopefully, with some publicity, and amateur operator support, we will soon see a new generation of rigs which are truly plug-and-play with respect to the up-and-coming digital modes.

Great idea! . . . Wayne

Uh-Oh, Canada!

Earlier this year, a major snafu in our distribution system caused all Canadian subscription copies of *73 Amateur Radio Today* to be held up in a warehouse somewhere (presumably) close to the Arctic Circle. By the time we got a sled team together to retrieve the magazines, Canadian subscribers had missed a couple of issues. By now, all Canadian subscribers should have received all of the missing issues.

As a way of making amends to our ham radio brethren (and sisters) north of the border, all Canadian subscribers active on March 1, 1993, will have two free issues added to the term of their subscription. We know that this in no way makes up for the trauma of not receiving your regular dose of *73 Amateur Radio Today*, but we hope you'll forgive us anyway.

New Repeater Packet Rules Proposed

The FCC has taken a long-awaited step towards establishing new policy for ham stations involved in automatic message forwarding. The commission has adopted its Notice of Proposed Rulemaking—a measure which foreshadows new regulations which will hold repeater control operators harmless for any prohibited communications instantly retransmitted through the repeater.

Under the new rules, only the originators of instantly-retransmitted communications are to be held accountable for content violations flowing through a repeater. But when it comes to packet, the FCC wants to hold both the originating and first forwarding station licensees responsible for prohibited communications. The idea is that a packet message could be reviewed, but repeater traffic is instantaneous.

Under the rules currently in effect, each amateur station is fully responsible for assuring that the contents of every transmission from his or her station complies with the rules. Generally speaking, this was never a problem for hams until the advent of high-volume, high-speed digital message forwarding systems. *TNX W5YI Report, Vol. 15, April 15 1993.*

Details Released on 219-220 MHz Access

The FCC has fleshed out its Notice of Proposed Rulemaking to "... provide a secondary allocation for the Amateur Service in the 219 to 220 MHz band to be used for amateur auxiliary station (point-to-point) packet backbone and other amateur point-to-point fixed communications." In response to a petition filed by the ARRL, the commission is proposing to allocate, on a secondary basis, the 219-220 MHz band for inner city wideband

packet radio networks and other point-to-point fixed operations.

According to the commission, this will (a) relieve the congestion in the 222-225 MHz band, (b) encourage the development and implementation of a packet network that can be used for emergency and national defense communications, (c) facilitate connection of local packet nodes to form such a regional or nationwide network, and (d) provide spectrum for exploration of new technology. *TNX W5YI Report, Vol. 15, April 15 1993.*

ITU up to 176

Three new countries from the former U.S.S.R. have joined the International Telecommunication Union as members so far this year. They are Georgia, Slovakia, and Kazakhstan. The ITU now has 176 member nations. *TNX W5YI Report, Vol. 15, June 1 1993.*

Special Club Callsigns Approved

The FCC has amended its Amateur Service rules to provide for volunteer organizations to administer a system designed to provide special callsigns to club and military recreation stations. This action was authorized by the Telecommunications Authorization Act of 1992. Organizations selected for the new system will be known as "Club and Military Recreation Station Call Sign Administrators."

To qualify, the club must exist for the purpose of furthering the Amateur Service, must be comprised of at least one percent of all hams licensed by the FCC, and must be capable of serving as administrator in all places where the Amateur Service is regulated by the FCC.

Each administrator will be assigned a block of two-by-three-letter callsigns. Dates for accepting administrator applications have not yet been announced. *TNX Westlink Report, No. 650, May 27, 1993.*

Consolidating VE Programs

Novices will soon be folded into the same licensing examination process as everyone else, under an FCC measure adopted on May 3rd. Currently (at press time), there are two different examination programs in the Amateur Service. For years, Novices have been informally tested by two volunteers. The Technician through Amateur Extra Class candidates have been tested under the VEC system—using teams of three accredited Volunteer Examiners. The three are managed by a Volunteer Examiner Coordinator who acts as a liaison between the VEs and the FCC.

Apparently, the Commission likes the way that the VEC program is going, because the

rate of errors has plummeted and the system is saving taxpayers an estimated \$1 million each year. The Novice testing system has an estimated error rate of nearly 10 percent and data collection has also been a weak point. The commission also hopes to minimize fraud by consolidating the VE programs.

The new FCC rules take effect July 1, 1993, placing responsibility for the preparation and administration of the Novice Class operator license examinations under the VEC system. The commission also has decided to allow for recovery of out-of-pocket costs for coordinating and administering such examinations. *TNX W5YI Report, Vol. 15, June 1 1993.*

Senator Extols Amateur Service

A Joint Resolution (S.J.90) has been introduced in the United States Senate recognizing the achievements of radio amateurs. Senator Charles Robb of Virginia drafted the bill, which calls for a national policy supporting amateur radio.

The resolution urges adoption of rules and regulations that encourage the use of new technologies within the Amateur Service. It also requests that any regulations which are necessary at any level of government be crafted in ways that encourage ham radio as a public benefit. *TNX Westlink Report, No. 650, May 27, 1993.*

French Launch Orbiter

A new satellite has joined the amateur radio community. Sponsored by the French Radio Amateur Club de l'Espace (RACE), the ARSNE (UO-22) satellite was sent into orbit from an Ariane-4 rocket right on schedule on May 12 at 00:56 UTC. It was launched from the European Space Agency's spaceport in Kourou, French Guiana, on the northern coast of South America.

After all the minor bugs are worked out of the satellite, the ARSNE will be open to packet traffic from all radio amateurs worldwide. The orbiting digipeater is equipped with an uplink frequency of 435.100; downlink 2446.5 MHz. *TNX W5YI Report, Vol. 15, June 1, 1993.*

TNX . . .

... to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine*, Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppn 70310.775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one stop bit. News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327.

A Decade of Packet

An anthology of 73 packet radio articles from 1983 to 1993.

by Charles Warrington WA1RZW

It may seem hard to believe, but the new technology we call packet radio has been gaining popularity with hams for some 10 years now! Regular readers of 73 know this magazine has given the subject intensive coverage. Not only will you find Jeff Sloman N1EWO's monthly column, "Packet & Computers," but you'll also find a compendium of construc-

tion articles, product reviews, and a few surprises—ranging from backpack units to space shuttle communicators.

If you've waited 10 years to get into packet, perhaps this little treatise is just the boot your system needs. Here you will find a handy-dandy index of 73 packet articles, and a brief abstract of each. We have also in-

cluded separate listings of packet columns and packet product reviews. Now you can dig out whatever information you need for a painless packet primer. If, on the other hand, packet is already part of your ham radio repertoire, we hope you will find this to be a valuable resource which will help to enhance your knowledge and future enjoyment.

Chronological Listing of 73 Packet Articles

"Join the Packet-Radio Revolution. Get error-free, high-speed communications. Packet radio's chief architect, WA7GXD, explains what it is and how it works." (by Lyle Johnson, Sept. 1983, p.19.) "This article is written to give the reader a practical look at packet radio, including a practical description of the equipment needed to use this new communications mode. . . . While the reading should prove interesting, the application of packet radio in *your* hamshack is the primary goal."

"Join the Packet Radio Revolution, Part 2. Warm up your soldering irons. This part offers the nuts and bolts of building your own TNC." (by Lyle Johnson WA7GX, Oct. 1983, p.20.) The author describes the Tucson Amateur Packet Radio (TAPR) Terminal Node Controller (TNC), and gives enough detail for the homebrew artist to build one.

"Join the Packet Radio Revolution, Part 3. Don't mess up. Packet protocols and procedures are all-important, says WA7GXD, and he's been right so far." (by Lyle Johnson, Jan. 1984, p.36.) In the final installment of his three-part series, WA7GXD illustrates the formal rules governing packet information transfer and tips for practical application.

"GLB Update" (QRX, March 1985, p.7.) "Packeteers using GLB TNCs, in particular those using them as digipeaters, should contact GLB for an update of their software." This short item includes where to send PROMs for update.

"Packet Places" (QRX, May 1985, p.8.) This short item presents a list of frequencies where you can find packet activity at various locations around the country.

"TAPR Two-Tone" (QRX, Sept. 1985, p.7.) This short item offers a commercially-made cabinet for the TAPR TNC-1 from Heathkit.

"Packet Panic!" (QRX, Nov. 1985, p.8.) This short article outlines packet radio's rapid

growth and some recent software developments.

"Packet Reprieve" (QRX, May 1986, p.7.) Short news item explains that, for the present time, third-party traffic sent via packet radio is legal—per the FCC.

"TNC Fix" (QRX, May 1986, p.7.) Item contains a modification which can be performed on a TAPR TNC-2 or an AEA PK-80 to prevent interference.

"A Packet Primer. First you've got to know the lingo." (by Gwyn Reedy W1BL, Aug. 1986, p.28.) In this comprehensive article, the author discusses why packet is becoming so popular. He compares packet's advantages and disadvantages with those of its technological ancestors.

"How to Make Friends at 1200 Baud. W2JU's guide to AX.25 etiquette." (by Norm Sternberg, Aug. 1986, p.34.) "This article offers a few collected thoughts and suggestions about: bandwidth of transmitted signals, transmitter keying characteristics and time constants, TNC parameter values (especially timing), beacons, and channel courtesy and good manners."

"Precision Packet Tuning. Build the ultimate digital tuning indicator for packet or RTTY." (by John W. Langer WB2OSZ, Aug. 1986, p.40.) Includes the schematic, circuit board design, parts list, etc. for constructing this project.

"So You Want To Be A Sysop? It's not as easy as it looks." (by Jon Pearce W2MNF, Aug. 1986, p.50.) "This article describes some of the trials, tribulations, frustrations, and rewards of becoming a packet BBS sysop." The article is also useful reading for the user, and includes instructions for smooth system operation.

"Birds 'N' Bauds. Satellites are going digital in a big way—Five international experts combine to define our place in space." (by Harold Price NK6K, Tak Okamoto JA2PKI, Hanspeter Kuhlen DIYQ, Peter Guelzow B2OS, Donald Moe DJ0HC/KE6MN, Aug. 1986, p.58.) This article discusses the frontiers of ham satellite technology and provides hints on how to take advantage of these advancements.

"Connect Alarm! Let your TNC call you when it has something to say." (by Louis I. Hut-ton K7YZZ, Aug. 1986, p.66.) A quickie construction project which, when attached to your TNC, sounds an alarm whenever there is a connect to your packet system.

"Survival Training For Mountaintop Digipeaters. A ROM with a view." (by George Flammer WB6RAL, Aug. 1986, p.68.) "This article describes a network of mountaintop digital repeaters covering the state of California." It includes network goals, trials and tribulations, and a look at the future.

"Beyond Level Two. High-level networking comes to packet radio." (by Phil Karn KA9Q, Aug. 1986, p.74.) "This article is for the user who is ready to take the advanced packet course. It discusses issues at the center of the next round of technical development."

"And If That Wasn't Enough . . . NK6K takes questions from the audience." (by Harold Price, Aug. 1986, p.80.) Five pages of packet questions and answers.

"On The Shelf" (by Harold Price NK6K, Aug. 1986, p.86.) An amateur packet bibliography. A good source for further reading.

"Packet Lunacy" (QRX, Oct. 1986, p.7.) In this short news item, W3IWI has successfully bounced packets off the moon.

"G/ACK" (QRX, Feb. 1987, p.7.) Short news item features a breakthrough for packet radio in Great Britain.

"Packet RATS. WA3DNN's Resume-After-Transmit Scanner lets your IC-27A do double duty." (by David C. Wolovitz, May 1987, p.30.) This construction article allows you to upgrade your IC-27A by connecting this home-brew Resume-After-Transmit Scanner to your digipeater.

"The Digital Novice. K9EI covers the basics and terminology of ham's digital world—from Samuel Morse's basement to packet proficiency." (by Jim Grubbs, June 1987, p.28.) The author presents options for the beginner who has

not yet experienced any of ham's digital communication modes.

"Big Time Packet. KITE can control a packet station from his desk or anywhere in the world—with a little help from his computer." (by Bradshaw B. Lupton, Jr., July 87, p.44.) The author describes how his passion for packet has made his workday lunch hour (and his correspondence) move along quickly.

"The Year 2000—Packet Radio Then and Now. The author predicts packet radio of the future—using today's technology." (by Bill Ashby K2TKN, Aug. 1987, p.24.) The author gazes into his crystal ball and attempts to describe the state of the art in the next millennium.

"AI on Packet?" (by William McMullan KE5L, Aug. 1987, p.29.) The author presents his "TRON" computer program, which will run your packet station automatically but does not actually use AI (artificial intelligence).

"U.S. Packet Digipeaters/PBSs" (by Don Bennett K4NGC, Aug. 1987, p.33.) A list of packet digipeaters and packet bulletin boards reported to be on packet radio in the United States.

"IC-2AT Packet Interface. Use WB5WSV's external PTT circuit to get on packet with an IC-2AT and an MFJ-1270." (by Wayne Eleazer, Aug. 1987, p.49.) This article shows you how to build a circuit which will allow the IC-2A to key up when connected to an MFJ-1270 TNC.

"On the Road and On the Air. Tales of a high-tech nomad." (by Steven K. Roberts KA8OVA, Feb. 1988, p.11.) The author developed a high-tech bicycle equipped with packet radio, among other things. He also discusses life on the road with his bike.

"Emergency 'Pocket' Packet. Instant packet in your jacket." (by David McLanahan WA1FHB, Apr. 1988, p.25.) A complete portable emergency packet station utilizing the ICOM O2-T, the GLB K1-L TNC, and the NEC 8201A laptop.

"Bicycle-Mobile Packeteering. It's time to pull packet radio out of its infancy!" (by Steven K. Roberts N4RVE, Apr. 1988, p.41.) The author picks up where he left off in his February article.

"The Care and Feeding of a PBBS. Timely tips for packet bulletin board users (Part 1)." (by David McLanahan WA1FHB, June 1988, p.23.) "One of the perks of working packet is being able to access one or more of the Packet Bulletin Board Systems springing up all over the country." The author teaches you how to take advantage of these PBBSs.

"Care and Feeding of a PBBS. Timely tips for packet bulletin board users (Part 2)." (by David McLanahan WA1FHB, July 1988, p.60.) The author continues where he left off in Part 1 with some final tips for packet BBS users.

"Digicom>64. A software-based packet radio system for the Commodore 64." (by Barry

N. Kutner, M.D. W2UP, Aug. 1988, p.22.) A cheap 'n' easy packet radio system, including circuit descriptions and schematics.

"Packets Full of Pixels. Packet Scan Amateur Television." (by Robert G. Pratt WD8AQX, Oct. 1988, p.10.) The author has found a way to combine amateur radio, computers, and video into "... a fun-filled super hobby that results in very slow-scan television images sent across town or around the world via packet radio."

"Ham Call Directory on Packet." (QRX, Nov. 1988, p.9.) A short news item. A Virginia ham (no pun intended) has compiled a CD ROM database of US amateurs which is accessible by packet radio.

"Scotland" (QRX, Dec. 1988, p.9.) Tiny news item. "Packet digipeating has come to Scotland."

"Packet Tuning Indicator. Dead-on HF packet tuning for \$15." (by Ronald B. Koester W2EKY, Dec. 1988, p.24.) This easy and inexpensive construction project includes the schematic, circuit board design, and parts list.

"TCM 3105 Modem for the Digicom>64. A mini-modem for 1200 baud packet." (by Craig Rader N4PLK, John Krohn KJ4GP, Sam Baine W4KUM, and Mike Zincola WD4PVS, Feb. 1989, p.42.) This project is a modem for the Digicom>64 TNC Emulator program that works exclusively on 10 meters, VHF, and UHF at 1200 baud. Circuit board design, parts placement diagram, and schematic are provided for this small and inexpensive home-brew.

"Getting High on Packet. Excellent advice for getting on HF packet." (by Brian Lloyd WB6RQN, Feb. 1989, p.50.) This "how to" article gets you started on HF packet including theory and practical operating suggestions.

"The Net/ROM-NordLink Question. A case of software piracy?" (by Neil Shapiro WB2KQI, June 1989, p.34.) A discussion of a legal battle over software rights which an American firm claims were violated by a German firm. The software in question was designed to enhance packet radio data transfer.

"Packet Racket Lip Zipper. Automatically turns off your rig's speaker during packet operation." (by Michael J. Geier KB1UM, Oct. 1989, p.13.) "The Lip Zipper switches the audio output of your rig from an external (or internal) speaker to the audio input of your TNC. In addition, you can use it to switch the rig's mike input between the mike and the TNC." Schematic and parts list are included.

"Setting Up a Packet Radio Station. An excellent guide for beginners and veterans alike." (by Brian Lloyd WB6RQN, Oct. 1989, p.14.) This is a step-by-step guide for the packet beginner which discusses equipment selection and how to configure the system.

"My SX-64 Runs Digicom! Low-cost packet solution for your portable C-64." (by Ted Drude KA9ELV, Oct. 1989, p.24.) "If you couldn't figure out how to get Digicom running

on your SX-64 portable, you can get the complete story here, including how to modify Digicom modems to work with the SX-64, and how to make the proper internal connections."

"Digital Dreams. We have not yet begun to packet!" (by Bdale Garbee N3EUA, Oct. 1989, p.28.) This article describes ways in which you can "turbo-charge" your packet station. The author discusses a variety of frequency options, networks, and software advancements to help the packeteer reach his or her potential.

"Let the TNC Work While Your PC Sleeps. Give your older TNC personal mailbox capability—with no hardware changes!" (by David Bartholomew WB6WKB, Oct. 1989, p.30.) This brief article outlines a procedure by which you can "turn your packet answering machine on."

"Put Your IC-22S on Packet. Dust it off and dedicate it to 2m packet!" (by Michael S. Dooley KE4PC, Oct. 1989, p.31.) "Are you tired of tying up your synthesized radio on packet? If you have access to an ICOM IC-22S, a fast and easy fix will get it on this fascinating mode."

"KAM Box. Packet and WEFAX for the lazy." (by Joe Davidson N4AQQ, Oct. 1989, p.32.) The author tells you how to modify the Kantronics UTU to allow you to take advantage of packet and weather fax modes. "These alterations have made a very nice operating interface just a little more friendly."

"One-Chip RS-232 for the C-64. Easy and inexpensive RS-232/TTL level interface." (by Mike Kabala KBØCDQ, Oct. 1989, p.34.) The author explains how you can build an interface to convert all the Commodore's signals from TL levels to levels that agree with the EIA standard. PC layout and parts list are included.

"Packet Radio in Japan. Bits of information on packet in the land of the Rising Sun." (by David Cowhig WA1LBP, Oct. 1989, p.38.) A news roundup of packet radio in a country the size of California with 1.6 million hams.

"Standardizing the Radio/TNC Interface. Patch any rig to any TNC or data controller in just a few moments!" (by Brian Lloyd WB6RQN, Oct. 1989, p.40.) The author describes the perfect interface (project) for that packet-rat ham who has collected five different radios and five different TNCs.

"Packet Radio and High-Tech Nomadics. A sneak preview of the Winnebiko 3." (by Steven K. Roberts N4RVE, Oct. 1989, p.48.) The author is the inventor of computerized, ham-radio-equipped bicycles which he has pedaled across the United States. This article examines his third generation bike, which is packet equipped.

"Improve your TNC's DCD circuit. Make your DCD faster and more discriminating." (by Eric Gustafson N7CL, Oct. 1989, p.50.) "The DCD circuitry for nearly all currently available TNCs are deficient for use on a radio channel.

Some are better than others, but most can be dramatically improved." A schematic is included for this project.

"TexNet Packet-Switching Network. An overview of a highly successful and efficient packet radio network." (by Greg Jones WD5IVD, Oct. 1989, p.54.) TexNet is "an inexpensive, multi resource, four port, high-speed 'backbone,' datagram-based amateur packet switching system." The author presents an overview of a very fast 9600 baud amateur network.

"Amateur Packet Networking. Going beyond just AX.25 . . ." (by Brian Lloyd WB6RQN, Oct. 1989, p.60.) "This article covers some networking concepts, explains where the original popular ham packet protocol, AX.25, falters, and compares and contrasts the more popular networking protocols."

"TCP/IP for the Macintosh. Now this powerful PC runs one of packet radio's hottest networking systems!" (by Doug Thom N6OYU and Dewayne Hendricks WA8DZP, Oct. 1989, p.68.) Transport Control Protocol/Internet Protocol can provide hams with many capabilities never before available in packet communication. The article includes an address where you can purchase the program on disk for \$5.

"HF Packet Tuning Aid. Spot-on tuning every time!" (by John Reed W6IOJ, Oct. 1989, p. 80.) Build this easy to use packet signal synthesizer. The schematic and parts list are included.

"The Quickchanger. This makes mixed-mode/band operation a breeze." (by Howard E. Cann KA3MRX, Oct. 1989, p.84.) This easy home-brew is "an interface box that lets you switch a single mike, a TNC, a phone patch, and two speakers, all to either HF, VHF, or off."

"The Great San Francisco Quake '89. Hams fulfill the purpose of the amateur radio service." (by Bill Pasternak WA6ITF, Feb. 1990, p.18.) Digipeating Packeteers prevailed in the big earthquake's emergency communications.

"Grant for HF Packet Research" (QRX, Apr. 1990, p.7.) Tiny news item. "A team will investigate the benefits of diversity reception for HF packet radio . . ."

"SAREX-90. Ham-in-space shuttle missions." (by Tom Clark W3IWI, Ron Parise WA4SIR, and Bill Tynan W3XO, May 1990, p.9.) This comprehensive article on hearing and working the astronauts includes a section on packet.

"SateLife Packet." (QRX, June 1990, p.7.) Experts in Boston and Moscow are teaming up to save lives by bringing lightning-fast medical data to third world doctors via packet.

"TNC Connect Alarm. Did anyone call when I was out?" (by Mark Schmidt DA1AU/WB9EGA, June 1990, p.14.) This easy home-brew is like an answering machine for your packet radio station.

"PK-232 Connect Memory. Lets you know what you missed. (by William Bleher W8GQL, July 1990, p.44.) This simple construction pro-

ject lets you know if a connection occurred to your packet station when you were away.

"SAREX Packet Hints." (QRX, Nov. 1990, p.7.) Advice for successful shuttle communications including using the proper call sign.

"Portable Backpack Packet Station: Behold the Back Packet! Go take a hike with packet radio." (by John Trent Adams NW6H, Dec. 1990, p. 9.) You can " . . . provide reliable communications at a moment's notice from any weird location . . ." with this innovative project. "The BackPacket consists of a PacComm Micropower-2 TNC, an Epson PX-8 laptop, a Yaesu FT-203 HT, a 7 amp-hour sealed lead-acid battery all encased in a sturdy Ensolute laminate in a Jansport daypack."

"Upgrade your HD-4040. KISS your Heath D-4040 and keep X.25 too!" (by Mark Dieter N2BLI, Dec. 1990, p.19.) "Very few parts are required to install this upgrade in your TNC: the TAPR KISS TNC 1 EPROM, a good quality DPDT switch, and a few strands of small-gauge wire."

"W1AW Packet BBS." (QRX, Jan. 1990, p.7.) "The ARRL has reinstated its packet radio BBS, W1AW-4, after more than a year off the air."

"Packet with the Microsats. The secrets of success." (by David Medley KI6QE, March 1991, p.9.) A seasoned ham (sorry) shares his favorite tidbits for getting the most out of orbiting packet.

"The End of Packet." (QRX, April 1991, p.7.) A chill was sent through the packet radio community when eight amateurs were fined \$300 each in connection with a political message. This appears to be the first time the FCC has penalized intermediate packet station operators for a message they did not originate.

"New Rules Sought" (QRX, May 1991, p.7.) "The FCC has accepted a petition requesting that primary responsibility for the content of all automatically retransmitted signals be placed on the originating station."

"Packet Challenge" (QRX, July 1991, p.7.) This is another update on the FCC fines for automatic packet message handlers.

"Poor Man's Packet. A complete software TNC for PC compatibles!" (by F. Kevin Feeney W2EMS and Andy Payne N8KEI, Aug. 1991, p.8.) This home-brew uses your PC to do the work of the TNC. The software is on disk instead of ROM. "Using this design you can build a simple, inexpensive packet communications system." It's a good way to get your feet wet in packet.

"The Lappack. Extended portable power for your laptop computer." (by Brian Kassel W5VBO, March 1992, p.52.) This construction project provides the 9.2 VDC required by some laptops by converting power from a 12VDC source.

"Packet on the Mac. Connect with the world without a TNC." (by Dexter Francis KD6CMT, Oct. 1992, p.8.) This article has all the information you need to build a 'PacketMac

Modem,' which will eliminate the need for an external TNC. A PC board is available.

"Packet Radio and Emergency Communications. Public safety enters the digital world." (By Richard Ferguson KAØDXM, Oct. 1992, p.42.) A comprehensive look at emergency packet is presented, including what you'll need to know to start a successful ham radio emergency group.

"ARRL Kills Automatic HF Packet Forwarding." (QRX, Nov. 1992, p.7.) In this short news item, the league has decided to accept the Digital Committee's recommendation that unattended HF packet forwarding should not be allowed.

"IARU Region 2 Meeting Formally Recognizes HF Packet." (QRX, Dec. 1992, p.6.) "The International Amateur Radio Union Region 2 Conference was held . . . and the decisions will definitely have an impact on the future of high-frequency fully-automatic packet radio forwarding worldwide."

"Packet Radio Equipment Needed for Poland Center." (QRX, March 1993, p.8.) The American Council for Polish Culture is seeking new or used packet equipment to enhance training opportunities.

"Digital Satellite Gateway Nodes. How to get on OSCAR 22 with an HT." (by John A. Hansen WAØPTV, March 1993, p.19.) "The satellite gateway node system is a fairly new development in packet radio satellites. It permits region-wide access by hams with anything from very modest equipment to the latest in digital satellite technology."

"Portable Packet Digipeater for Emergency Service." (by John Neeley K6YDW, June 1993, p.16.) Build this highly portable, battery powered digipeater. Parts list, schematics, and PC board design are all included.

Chronological Listing of 73 Packet Columns

"NK6K>Packet" (by Harold Price, May 1986, p.86.) In this first packet column, the author introduces you to some **packet radio definitions** and reviews the history of packet. He also explains why packet is virtually error-free.

"NK6K>Packet" (by Harold Price, June 1986, p.76.) The author continues his discussion of **packet basics** including a discussion of the costs involved in getting started.

"NK6K>Packet" (by Harold Price, July 1986, p.88.) A discussion of the **new packet products** offered at Dayton this year.

"NK6K>Packet" (by Harold Price, Sept. 1986, p. 88.) **Packet in other lands** is discussed, including Japan, South Africa, and the U.K.

"NK6K>Packet" (by Harold Price, Oct. 1986, p. 60.) The author discusses **baud rate** and how it is related to transceiver delay time.

"NK6K>Packet" (by Harold Price, Nov. 1986, p.74.) The author addresses a variety of

subjects including **moon bounce** on 432 MHz and third-party traffic in relation to packet operation.

"NK6K>Packet" (by Harold Price, Dec. 1986, p.66.) The first large-scale **packet radio survey** questionnaire is presented.

"NK6K>Packet" (by Harold Price, Jan. 1987, p.70.) The author discusses **high-speed modems**, HF forwarding networks, and restricted BBSs.

"NK6K>Packet" (by Harold Price, Feb. 1987, p.66.) The author discusses what should be included in a **packet message header**.

"NK6K>Packet" (by Harold Price, March 1987, p.82.) Results from the **packet poll** of December 1986 are presented.

"NK6K>Packet" (by Harold Price, Apr. 1987, p.76.) The author **answers questions** from readers. Topics include the recent survey and auto-forwarding.

"NK6K>Packet" (by Harold Price, May 1987, p.54.) The author reviews his **first year** writing a packet column.

"NK6K>Packet" (by Harold Price, June 1987, p.58.) The author delves into **coded packet transmissions**.

"NK6K>Packet" (by Harold Price, July 1987, p.56.) The author discusses the **AEA packet line**, OSCAR 12, and the FO-12 BBS.

"NK6K>Packet" (by Harold Price, Aug. 1987, p.50.) The author discusses the virtue of a **proposed FCC STA** (special temporary authorization) to allow HF stations to run unattended.

"NK6K>Packet" (by Harold Price, Sept. 1987, p.68.) The author continues his discussion of the **HF STA**.

"NK6K>Packet" (by Harold Price, Oct. 1987, p.54.) The author revisits the August 1987 packet issue and discusses using **laptops for packet**.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, Dec. 1987, p.59.) In his first packet column, the author discusses **transceiver enhancements** to better facilitate error-free packet communications.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, Jan. 1988, p.80.) The author discusses **protocols** and layer definitions.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, Feb. 1988, p.76.) The author looks at **narrow bandwidth FM** radios in common use on packet radio.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, Mar. 1988, p.76.) The author discusses **equalization and modems**.

"ATV" (by Mike Stone WB0QCD, Apr. 1988, p.58.) The author discusses **interfacing packet radio with amateur television**.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, Apr. 1988, p.67.) The author shows how packet radio can be used in an **emergency**.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, June 1988, p.60.) This column is devoted to building a **duplex digipeater for 2 meters** that requires little hardware and no software.

"QRP" (by Mike Bryce WB8VGE, June 88, p.67.) A short blurb describes **low power packet** operation.

"RTTY Loop—Amateur Radio Teletype" (by Marc I. Leavey, M.D., WA3AJR, August 1988, p.63.) Discussion of an **AEA PC Pakratt** program which can handle packet, Baudot, FAX, Morse, and AMTOR.

"Circuits—Great ideas from our readers." "Portable Packet" (by Dick Peters WA1PWF, Feb. 1989, p.76.) A very simple circuit which allows you to use your TNC with an ICOM HT.

"DX—Hams Around the Word" (by Chod Harris VP2ML, Feb. 1989, p.79.) **Packet DX Spotting Networks**, packet conference bulletin board, and packet cluster are discussed.

"73 International" "Packet Radio in South Africa" (by Peter Strauss ZS6ET, Apr. 1989, p.104.) A roundup of packet ham radio activities in the Republic of South Africa.

"Letters From the Hamshack." "Packet Racket" (Letter by John Shelley WA1IAO/response by Brian Hastings NS1B, May 1989, p.92.) Mr. Shelley calls packet an "electronic plague" while Mr. Hastings responds that clinging to the past could kill ham radio.

"Circuits—Great ideas from our readers." "Packet/Voice Switch Box." (by Robert L. Dingle KA4LAU, Aug. 1989, p.58.) A simple circuit you can build to avoid having to disconnect the input to the TNC and reconnecting the microphone in order to switch from packet to voice.

"Ask Kaboom—The Tech Answer Man" (by Michael Jay Geier KB1UM, Sept. 1989, p.61.) The author answers reader inquiry about a flickering DCD light when there is no signal on his **MFJ 1270 TNC**.

"Welcome, Newcomers!" (by Brian P. Lloyd WB6RQN, Oct. 1989, p.6.) A handy one page introduction to **packet terms and definitions**.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, Nov. 1989, p.50.) The author, returning from a one-year hiatus, discusses **packet bulletin boards and protocols**.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, Dec. 1989, p.46.) Topics this month include **courtesy using packet** on the ham bands and making AX.25 more efficient.

"Circuits—Great ideas from our readers." "3-Position, Multi-Mode Switch Box." (by David K. Pelaez, Dec. 1989, p.70.) Build an easy switch-box for RTTY, packet, FAX, and SSTV.

"Ask Kaboom—The Tech Answer Man" (by Michael Jay Geier KB1UM, Dec. 1989, p.72.) Fix a common cause of **QRM** on 2 meter mobile packet radio.

"Letters From the Hamshack." "Closer Look at ROSE" (A letter by Thomas A Moulton W2VY and response by Linda Reneau KA1UKM, Dec. 1989, p.76.) A reader responds to comments about the ROSE networking solution in a recent packet issue of 73.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, Jan. 1990, p.58.) Topics this month include two packet conferences, new products, and the **ARPANET/Internet**.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, Feb. 1990, p.58.) The author discusses ways in which **packet can be improved**, including better frequency coordination and more channels.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, March 1990, p.56.) The author talks about doing **800 Hz shift with the PK-232** and about a California grocery store which caters to computer hackers.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, Apr. 1990, p.54.) The author touches on the **universal interface**, PTT level converter, and the stagnation of packet radio.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, May 1990, p.58.) The author discusses **smart packet software** and especially SAREX features.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, June 1990, p.48.) The author discusses **10 meter packet** including upper and lower sideband operation.

"Hamsats—Amateur radio via satellite." (by Andy MacAllister WA5ZIB, June 1990, p.51.) **Modems for digital hamsat operation** are discussed.

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, July 1990, p.64.) The author answers mail and discusses the **"TAPR packetRADIO."**

"Packet Talk—Latest in Digital Hamming" (by Brian Lloyd WB6RQN, Aug. 1990, p.76.) Includes more on **800 MHz shift** and more on **10 meter packet** discussion from a previous column.

"Homing In—Radio direction finding." (By Joe Moell P.E. KØOV, Oct. 1990, p.52.) The author discusses **triangulation** by packet.

"Hamsats—Amateur radio via satellite." (by Andy MacAllister WA5ZIB, Dec. 1990, p.81.) A discussion on **packet via satellites** is presented, including **picture packets** from space.

"Hamsats—Amateur radio via satellite." (by Andy MacAllister WA5ZIB, Apr. 1991, p.70.) How to copy the **Soviet Mir Space Station** on FM packet.

Continued on page 18

"RTTY Loop—Amateur Radio Teletype" (by Marc I. Leavey, M.D. WA3AJR, Aug. 1991, p.69.) "**Packet or RTTY—Which is better?**" The author compares and contrasts two of amateur radio's popular digital modes.

"Hamsats—Amateur radio via satellite." (by Andy MacAllister WA5ZIB, Dec. 1991, p.62.) The author talks about **9600-bit-per-second packet** operation via low earth satellites.

"RTTY Loop—Amateur Radio Teletype" (by Marc I. Leavey, M.D. WA3AJR, Feb. 1992, p.62.) The author walks a packet newcomer through his **anxiety** over the new digital mode.

"Packet & Computers." (by Jeff Sloman N1EWO, Aug. 1992, p.62.) In the first installment of his new column, the author reviews a number of helpful suggestions for **network users and sysops**. Topics include PBBS directory services and the WB7TPY Packet/Internet Gateway.

"Packet & Computers." (by Jeff Sloman N1EWO, Sept. 92, p.78.) Subjects include **tuning up** your packet station, networks, repeaters and portable packet.

"RTTY Loop—Amateur Radio Teletype" (by Marc I. Leavey, M.D., WA3AJR, Oct. 1992, p.54.) The author explains to an RTTY user what he needs to know to take that **big leap into packet**.

"Packet & Computers." (by Jeff Sloman N1EWO, Oct. 1992, p.64.) Subjects this month deal with **portable packet** operation: batteries, TNCs, and carrying cases.

"Packet & Computers." (by Jeff Sloman N1EWO, Nov. 1992, p.62.) This month's column is devoted entirely to a **digital radio glossary**.

"Packet & Computers." (by Jeff Sloman N1EWO, Dec. 1992, p.74.) Includes good news about the Internet and highlights of the **N0ARY BBS**.

"Packet & Computers." (by Jeff Sloman N1EWO, Jan. 1993, p.72.) A discussion of **digital signal processing and digital filters** is presented.

"Packet & Computers." (by Jeff Sloman N1EWO, Feb. 1993, p.66.) This month's column focuses on **TexNet**.

"Packet & Computers." (by Jeff Sloman N1EWO, March 1993, p.48.) The main topic this month is understanding **asynchronous communications**.

"Packet & Computers." (by Jeff Sloman N1EWO, Apr. 1993, p.40.) In this first installment of a series, the author tells you how to quiet down the **RFI** in your hamshack.

"Packet & Computers." (by Jeff Sloman N1EWO, May 1993, p.40.) The author presents the second half of his discussion on **asynchronous communications**. (See March 1993.)

"Packet & Computers." (by Jeff Sloman N1EWO, June 1993, p.50.) This month's column looks at how packet operators (and hams in general) need to improve their **behavior** on the airwaves.

"Packet & Computers." (by Jeff Sloman N1EWO, July 1993, p.58.) This month, the author covers **hierarchical addressing**, the system by which packet traffic is routed.

Chronological Listing of 73 Packet Product Reviews

"Seeing Packet Radio With Different Eyes. The **Versabraille 2** system allows blind hams to get connected." (by Jeffrey Bishop 7FDS, Aug. 1986, p.48.) The author reviews Telesensory Systems Inc.'s word processor and communicator for the blind. It can be used with nearly any TNC to facilitate sightless packet operation.

"**MFJ-1270 TAPR-2 Packet TNC**" (by Marc Stern N1BLH, June 1986, p. 24.) The author reviews "... packet (for) the common man ... a TAPR NC-2 clone that's every bit as good, if not better, than the original."

"**73's Packet Buying Guide**" (Aug. 1986, p.88.) Table lists company, product, features, and price.

"**AEA PK-232 PAKRATT**" (by Perry Donham KW1O, Dec. 1986, p.22.) Advanced Electronic Applications put all of ham radio's digital modes into one station controller. The unit includes Morse, Baudot RTTY, ASCII, AMTOR, and packet.

"**The Heath HK-21 TNC**. Hand-Held TNC!" (by Tom Gilchrist N7KHU, March 1989, p.38.) "Heath calls the HK-21 a 'Pocket Packet' for a very good reason. It's a compact, self-contained TNC with a built-in personal packet bulletin board system (PBBS)."

"**DRSI PC*Packet Adapter**. Revolutionizes the PC/transceiver interface." (by Brian Lloyd WB6RQN, Oct. 1989, p.20.) "This board plugs in to your IBM or compatible and turns it into a complete packet radio communications system."

"**GRAPES 56 Kb Modem**. We've come a long way from 1200 baud packet." (by Philip R. Karn, Jr. KA9Q, Oct. 1989, p.42.) "How would you like to be able to send the equivalent of a standard 5.25" IBM PC floppy disk (360 Kbytes) by packet radio in less than two minutes? How about transmitting telephone-quality digital voice over the air?" The author reviews a fast modem distributed by the Georgia Radio Packet Enthusiasts Society.

"**PacComm's NB-96 High Speed Modem**. Dramatically increase packet data rates without buying a new packet system." (by Thomas A. Moulton W2VY and Robert A. Buas K6KGS, Nov. 1989, p.30.) A review of a 9600-baud modem that enhances most packet radio systems with no need to change rigs.

"**Pkt-GOLD Multimode**. Your software window into the world of digital communications!" (by Marc Stern WA1R, Aug. 1991, p.20.) "Pkt-GOLD Multimode is a program that turned out to be one of the best implementations of multimode controller software I have seen."

"**The TAPR METCON-1 Kit**. Add telemetry and control to your packet station." (by Bill Brown WB8ELK, Aug. 1991, p.34.) "How would you like to have the ability to read sensors or control circuitry from a remote location via packet radio?" With this kit, you can do it.

"**The Kantronics KTU Telemetry Unit with Weathernode EPROM**. Remote weather observations via packet!" (by Dick Goodman WA3USG, Aug. 1991, p.46.) "The flexibility in the way weather data may be captured and presented should meet the requirements of the most demanding amateur and professional meteorologists."

"**The BayCom Packet System**. Run packet without a TNC." (by Dick Goodman WA3USG, Dec. 1991, p.20.) This system is actually composed of two parts: "... a shareware program called 'BayCom,' and a simple modem." The reviewer calls it superb.

"**The Kantronics KPC-3**. Full-featured packet in a compact package." (by Mark T. Schmidt WB9EGA, Oct. 1992, p.30.) This tiny packet communicator offers a long list of features, including WEFAX and KA-Node.

"**The Tigertronics BP-1 Packet Modem**. Just add one computer for instant packet. (by Bill Brown WB8ELK, Dec. 1992, p.52.) "How would you like to get on packet for less than \$50? If you have an IBM compatible computer laying around, you only need to add the BP-1 Packet Modem and run a software packet program."

"**The AEA DSP-2232**." (by Jeffrey Sloman N1EWO, March 1993, p.17.) This product "... is a great example of how DSP (digital signal processing) can bring intelligence and flexibility to a product traditionally hardwired for a job."

Special Packet Issues

On three previous occasions, we have devoted an entire issue of 73 to packet. These are "must read" issues. They were published in August 1986, August 1987, and October 1989. **73**

Back issues are available while they last for \$4.00 each ppd. Reprints are available for \$3.00 per article. Send orders to 73 Amateur Radio Today, Reprints, 70 Route 202N, Peterborough, NH 03458.

LED BACKLIGHT

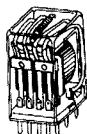
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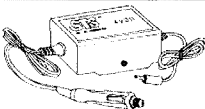
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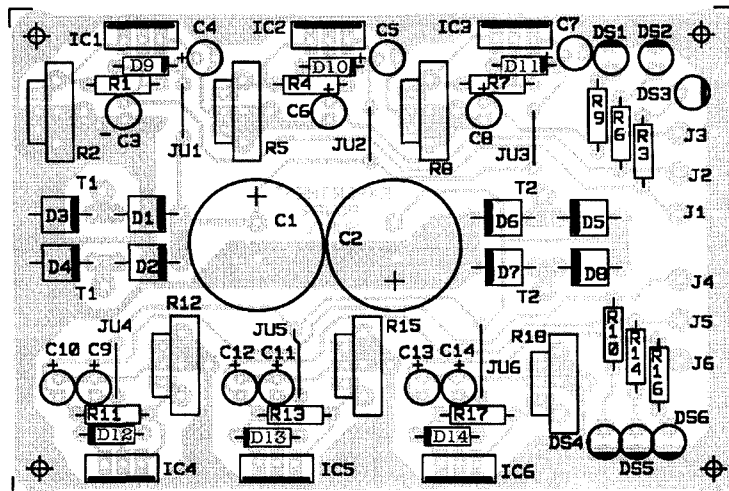
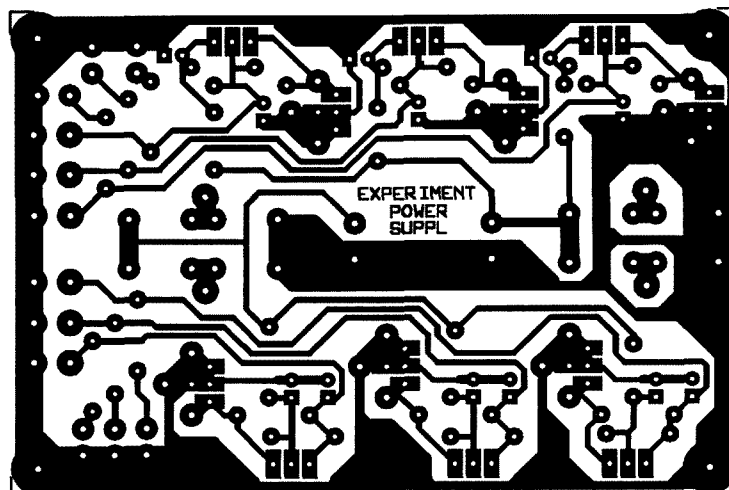
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UPDATES



FM Packet Deviation Meter

Put your packet station on the money for 20 bucks.

by Steven R. Sampson N5OWK

There are a lot of "plug-and-play" amateurs today, and many are working FM packet. While many traditional amateurs can draw a Bessel function chart with their eyes closed, this new breed of ham is a lot less technical. Many have a hard time digesting the concepts of bandwidth and frequency drift, never mind deviation. This article will help. It shows how to build a useful instrument, explains exactly why it is needed, and challenges the less-than-technical ham to expand his or her electronic expertise.

Like most newcomers to VHF packet radio, I set my system up by connecting all the cables and getting on the air. It wasn't too long before I checked my audio levels. Unlike voice, there aren't a lot of people who complain if your packet audio is too hot or too weak. Actually, I don't think anyone locally listens to the packet tones because I was hotter than a two dollar pistol. First I set my receive audio level, and this was simply an increase in volume until the TNC Data Carrier Detect (DCD) light illuminated, followed by a squelch adjustment (some TNCs can operate without squelch, and this is the better way to go). You can make a pretty good judgement about setting the transmitter audio level by listening with another radio, but the correct method is to use a deviation meter. You won't find inexpensive deviation meters at any radio store, so you're going to have to build one. This article presents a deviation meter based on William Crowl N6MWS's design from the January 1990 issue of *73 Amateur Radio Today*. The circuit uses parts available at Radio Shack, and will run about \$20. Bill's circuit featured many other useful functions which I deleted from this design to make it a simple one-evening project.

Figure 1 shows the schematic. This meter is based on simple AC voltmeter principles. It picks up the AC voltage from the receiver's FM detector, amplifies, rectifies, and drives the meter movement. The first stage takes the AC voltage from a scanner or your ham rig's discriminator output, blocks the DC, and amplifies it with a gain of three. The next two op amp stages form a clever full-wave rectifier function. The positive half of the input waveform passes around the second op amp to the third, while the negative half is inverted by the second stage,

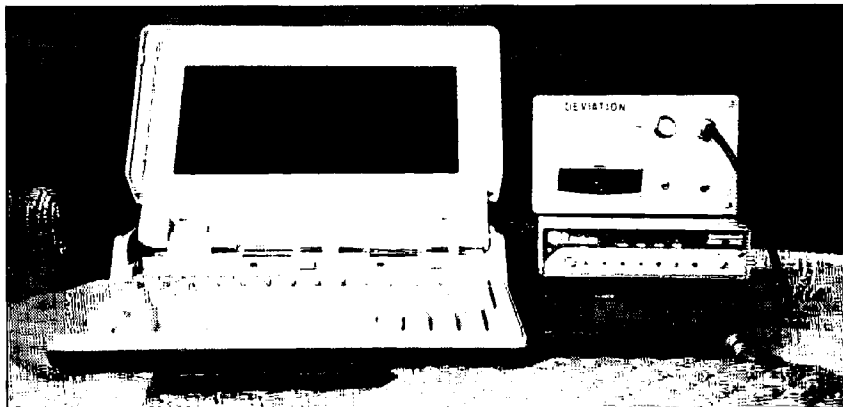


Photo A. The FM Packet Deviation Meter makes this station complete.

causing a positive output to the third stage. Bill recommends that you not change the values of the second-stage resistors. The circuit is based on the LM-324 op amp chip. It draws about 1 mA total and will last forever on a 9 volt battery. It's very simple to put together on a perfboard. See Figure 1.

Calibration

I've really enjoyed watching all the signals as much as listening to them, and it took a bit of analysis to figure out the best way to use the meter. After several days of monitoring signals over the air, I found that the whole range of the meter is used by various

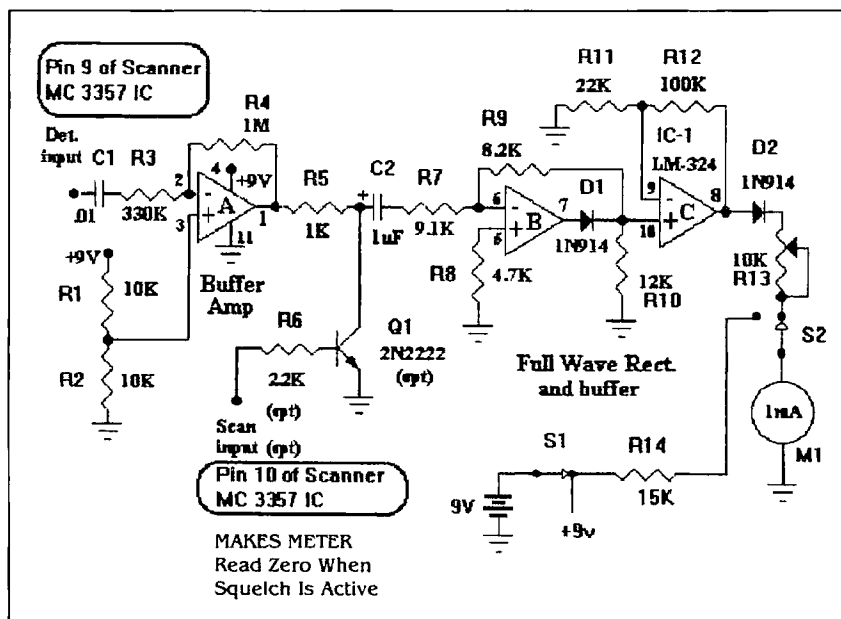


Figure 1. Schematic for the FM Packet Deviation Meter.

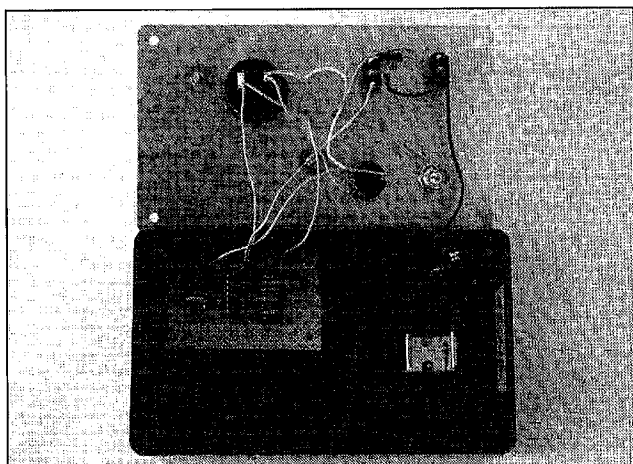


Photo B. The FM Packet Deviation Meter with cover removed.

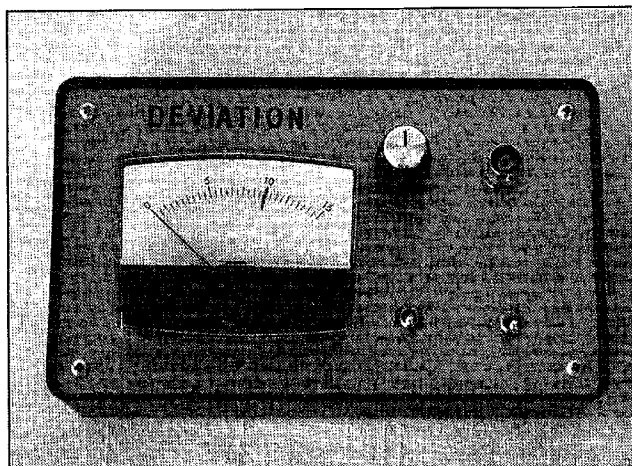


Photo C. The finished product.

packet stations. The really poor ones drive the meter against the 15 reading (over deviation), while no audio of course, drops it down to 0. I chose the 2/3-scale 10 reading as the best calibration setting.

Without a signal present, the discriminator outputs a noise waveform, so the calibration pot on the meter is aligned to center about this 10 reading. Calibration needs to be performed each time the frequency is changed. I usually monitor the frequency for a minute to make sure there is no interference, and then recheck calibration. Any anomaly causes me to change frequency and recalibrate.

When a packet is received, the meter will deflect downward for the good guys and upwards for the bad guys. It's important that you only measure signals that are full-quieting, as noise will throw the reading off. I find it best to keep the circuit portable and take it to the transmitter for alignment. RF is bad news for consistent readings, however. You can avoid this by both removing the scanner antenna and placing a dummy load on the transmitter. If your TNC does not have a variable deviation adjustment (a design defect), the common method is to wire a 10k ohm potentiometer into the audio line to the transmitter. Don't depend on high or low jumpers to operate correctly—these are sucker settings.

After these initial steps, I usually command the TNC into the "calibrate" mode and send the high tone. Another good method is to command the TNC to the "converse" mode and hold down the "return" key. I then quickly adjust the audio pot to my calculated 3 kHz deviation reading (about 8.0 on my meter). Unless you calibrate your meter to a known source you are only guessing about what the readings mean, as each discriminator is different. If you can't find a calibration source, you can listen to signals on the air or tune your station by ear to get an initial estimate. After a couple of days you will quickly come to know what is good and what is bad by monitoring the performance of both your own and other packet stations. The ob-

ject is to get a downward deflection.

Some radios produce a noticeable difference in the two AFSK packet tones. Here, you may want to do the alignment using the more critical high tone. As you might expect, any frequency error throws everything off, so make sure both the meter's receiver and the transmitter are tuned to the same frequency.

Deviation Basics

Whether an FM receiver has a discriminator, ratio detector, quadrature detector, or one of the modern phase detectors makes little difference as long as the output of the detector is proportional to the amplitude of the modulating tone. When a signal is fed to the FM modulator, it varies the frequency directly. The modulated FM signal is a variable set of sidebands whose total bandwidth depends both on the frequency of modulation and the amount of deviation. The limits set by the typical narrow band FM receiver IF stage is about 15 kHz.

The best method of determining the bandwidth of an FM signal is to use a Bessel function chart, as shown in Figure 3. You use this chart to find the number of sideband pairs and then compute the bandwidth. First you calculate the modulation index:

$$P = \frac{D}{m}$$

where P = modulation index, D = peak deviation, and m = modulating frequency.

Then you examine the chart to see how many sidebands there are on each side of the carrier. If the curve comes off the baseline a line-width or more, I include that sideband. The simple bandwidth formulas you find in textbooks are all different and can be considered unreliable. Use the chart. The worst case example is an FM signal that has been deviated 5 kHz with a modulating frequency of 3 kHz. The modulation index is 1.67, giving us four sideband pairs, or eight sidebands of 3 kHz, requiring an estimated 24 kHz bandwidth to contain it. This is quite acceptable for voice when it occurs only briefly. Packet uses a high tone of 2.2 kHz,

and the predicted bandwidth using 5 kHz deviation is a steady 22 kHz. Transmitting a signal with this wide a bandwidth is certain to fail with distant packet stations, and likely even to fail across town. There are two reasons: First, most rigs will clip the audio to limit the deviation, which causes distortion. The second reason is crystal stability. One rig may be tuned 1.4 kHz higher in frequency, and the other 1.4 kHz lower, and still be within crystal tolerance on 145 MHz. This gives us about 12 kHz of worse-case usable receiver bandwidth.

Using 3 kHz deviation results in a modulation index of 1.36, and the chart shows about four sideband pairs, or 8 times 2.2 kHz for a 17.6 kHz bandwidth on the more

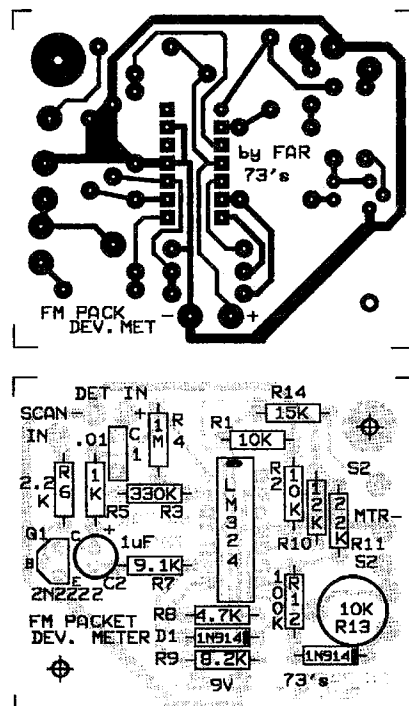


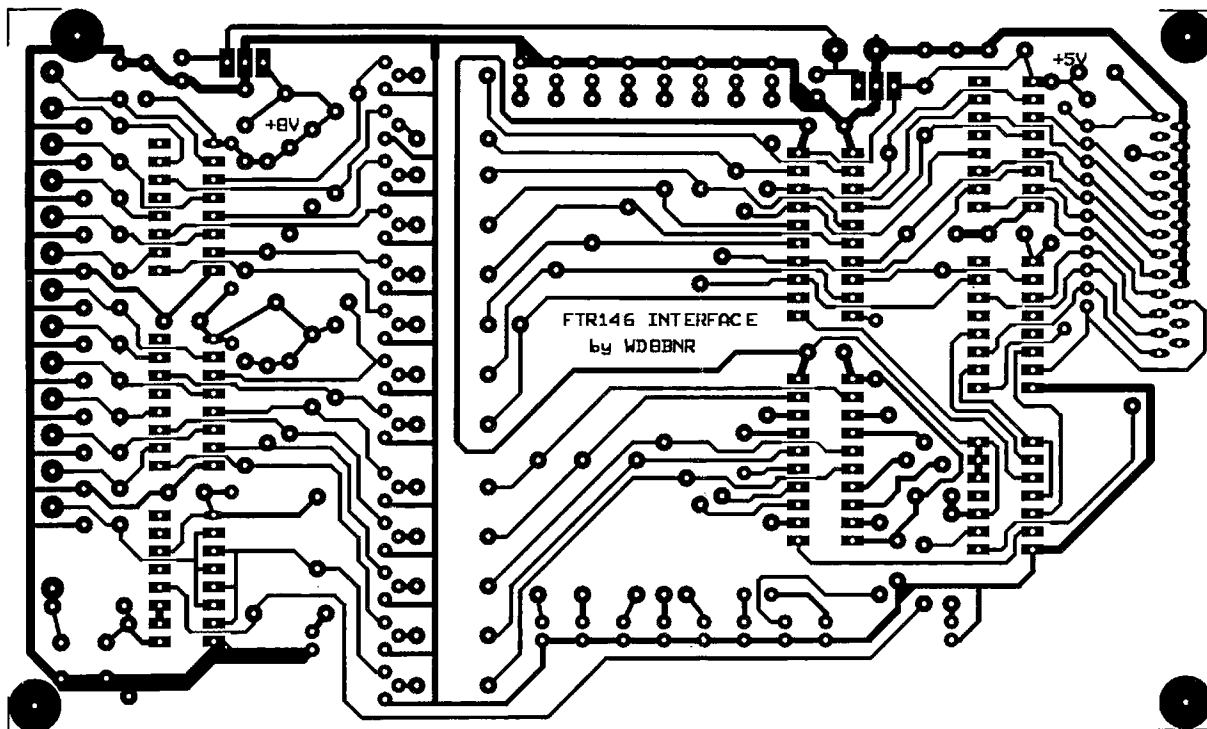
Figure 2. PC board pattern and parts placement diagram.

UPDATES

Computer Control For The Ramsey FTR-146

The above article by WD8BNR appeared on page 60 of the March 1993 issue of 73. We printed updates in the April and June issues. With this corrected printed circuit artwork, we hope to have all the bugs out.

Continued from page 20



Corrected PC artwork for the Computer Control for the Ramsey FTR-146.

The Noise Remover

See the above article by K8MKB on page 12 of the November 1992 issue of 73. In some installations, the circuit shown in Figure 3 breaks into oscillations.

Change R1 from 47k to 100k, and R3 from 680k to 470k. Put a 0.001 μ F capacitor across the input side of C1 to ground, and a 0.001 μ F capacitor from point A to ground (across R8).

For more output from the circuits shown in all of the figures, exchange the 0.0047 μ F capacitor with the 0.047 μ F capacitor. The series resistors R5, R9, R12 can be increased up to 4.7k

ohms. If you still need more output take out C3 and C6, and replace C4, C5, C7 with a 0.47 μ F tantalum. The limit adjust pot can be a 10-turn (not 25-turn) 10k pot.

73

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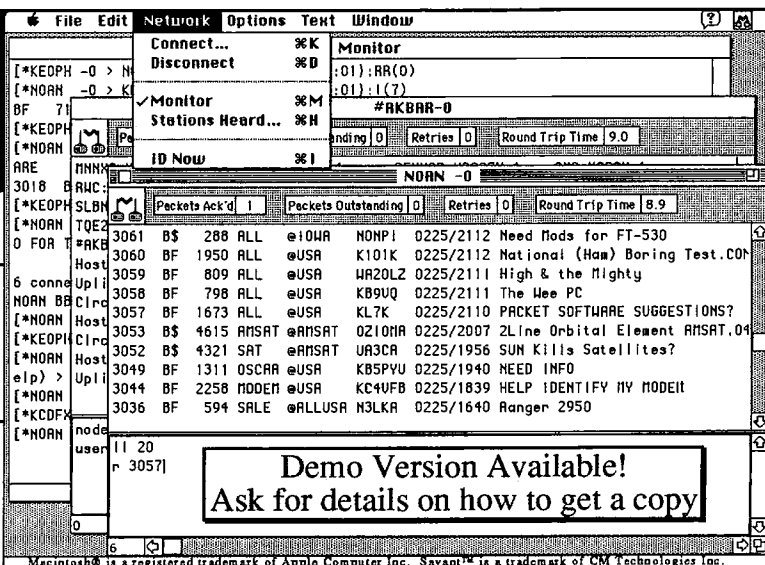
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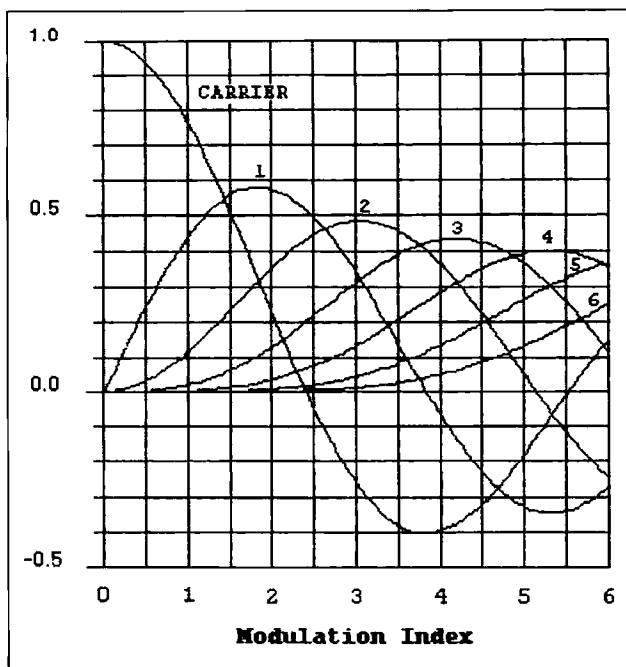


Figure 3. Bessel function chart..

critical high tone, and 12 kHz for the low tone. This reduced bandwidth is much less affected by the frequency drift between stations, and is not distorted by the transmitter deviation limiting circuits. By listening to the audio produced by 5 kHz deviation you will notice that it sounds raspy and terrible, while the 3 kHz sounds very pure.

Conclusion

The recommended setting for packet is 3 kHz deviation. With this meter you can quickly adjust your station, and others, to ensure that the transmitter hasn't gone into limiting, and that the bandwidth is optimized for the typical receiver. By spending a little time tuning up, you will benefit the entire

Parts List

Case	Plastic	RS#270-627
M1	1 mA meter	RS#270-1754
J1	BNC jack	RS#278-105
IC-1	LM-324	RS#276-1711
Q1	2N2222	(Optional)
D1,D	1N914	
R1,R2	10k	All resistors 1/8 watt
R3	330k	
R4	1 Meg	
R5	1k	(Optional)
R6	2.2k	
R7	9.1k	
R8	4.7k	
R9	8.2k	
R10	12k	
R11	22k	
R12	100k	
R13	10k	Potentiometer
R14	15k	Comes with RS meter
C1	0.01 μ F	Ceramic disc
C2	1 μ F	Electrolytic

Drilled and etched PC boards are available from FAR Circuits, 18N640 Field Ct., Dundee IL 60118 for \$4 plus \$1.50 S&H.

local network system. I found that my station was able to connect with distant nodes that I thought were unreachable due to my power level or antenna height. Loan the meter out, and make sure everyone gets a chance to use it. Thanks go to William Crowl N6MWS for an excellent article and a repeatable circuit design, and to Joe Buswell K5JB who helped me first to calibrate the meter and then to understand FM modulation.

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73 Review

by Jeffrey Sloman N1EWO

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By the time you read this, Pakratt for Windows (PPWIN) should be shipping—finally! It's been a long time, but, if you use Windows and own an AEA controller or TNC, you'll be glad you waited. The product I looked at was marked "preliminary," but it was pretty much the product that will ship, with a few rough edges still there. The fact is, even in this pre-release state, I prefer to use this product over any

ham radio digital communications software on the market.

The Next Generation

I used PPWIN to control the new PK-900, which you will find reviewed elsewhere in this issue. Together, these two make a truly state-of-the-art digital station for the avid operator. Think of PPWIN as a very-pleasant-to-use soft front end for AEA controller

hardware. It doesn't offer features found in other terminal programs like LAN-Link or PK-Gold—it wasn't designed to. Instead, you will find it an excellent replacement for learning the multitude of command line incantations required to make the hardware do all its tricks, and it offers the very user friendly Microsoft Windows environment.

PPWIN really knows AEA hardware. Through easy-to-use combo boxes—ed-

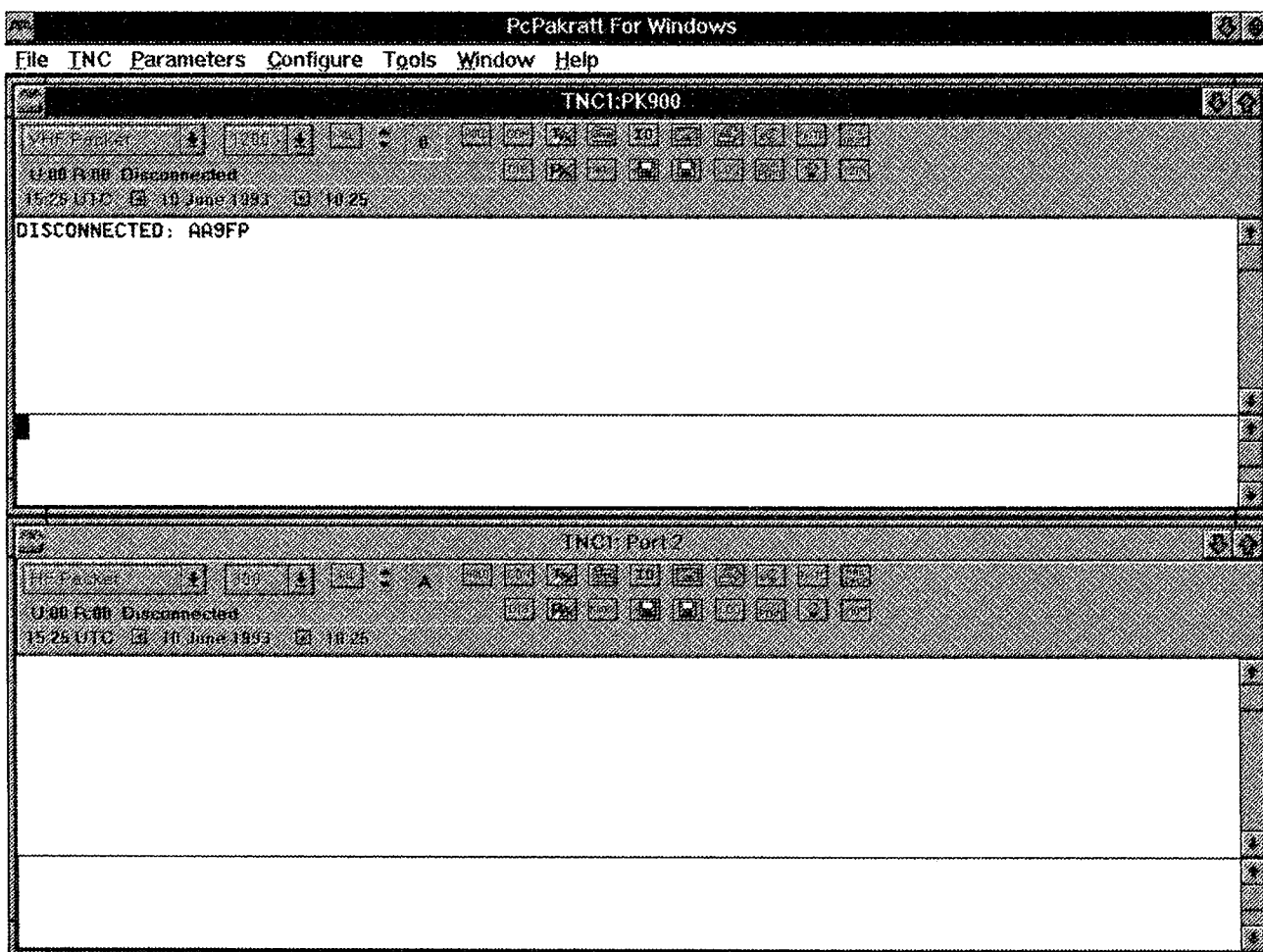


Figure 1. From Pakratt for Windows' main screen you can do just about everything your AEA controller is capable of.

itable fields with drop-down lists—and directly accessible buttons, PPWIN lets you control every aspect of any AEA controller. Forget hours with the manual trying to figure out everything your new controller does: With PPWIN all the options are right in front of you—or a few mouse clicks away.

The Main Screen

At startup, PPWIN greets you with a blank gray window and a menu bar, typical of any Windows application. The first step is to configure the program using the aptly named Configure menu. PPWIN can handle two different controllers, called TNC1 and TNC2. These can be any AEA product, from the top-end DSP-2232 to the budget-level PK-88. Selecting TNC1 from the Configure drop-down pops up a second menu which allows you to set various parameters relating to the controller.

Set Color

This option invokes a dialog box which can be used to set the text colors for text messages displayed in the TNC1 window when it is visible. Different colors can be set for text depending upon whether it is received, echoed, or a message from the controller. These color schemes can be different for each of the controller's virtual channels. This is a very useful feature for

those who run multiple connections.

TNC Configuration

This menu option offers access to the communications parameters used to talk to the controller, and allows the specification of a particular model. It also provides an array of check boxes for selection of initialization options.

Program Files

This option provides a way to specify files used by PPWIN for messages and other use. The files are specified by DOS path name, and push-buttons invoke standard browse boxes to help locate the desired file. There are quite a few files settable from this dialog box:

AMTOR Connect File
Buffer File
Port 2 Buffer File
Capture File Default
Macro File
Maildrop File
TNC Parameter File
Packet Connect File
PACTOR Connect File
QSO Log File
QSO Default File

Program Configuration

This dialog lets you specify a macro to execute at startup, and one for exit—a nice feature. This can save a lot of trouble if you normally do several things at either time. Also available in this box are the buffer sizes for each port (this defaults to 64K), and check boxes to decide whether one or both controllers will automatically open on startup.

QSO Log Defaults

This dialog offers fields for default entries in your QSO log. You can specify rig, antenna, frequency, and power. These can be overridden at logging time.

Opening a TNC

Once you have specified the various parameters you are interested in—the only required ones are in the TNC Configuration dialog—the TNC menu on the main menu bar will show the hardware you configured. Selecting either TNC will open and initialize your choice. If you have a two-port unit, like the PK-900 used to test the program, port 2 will be an additional choice on this menu. By cleverly using the controller's host mode, PPWIN can let you access both ports concurrently—each with its own visible window.

PPWIN opens a window for each con-

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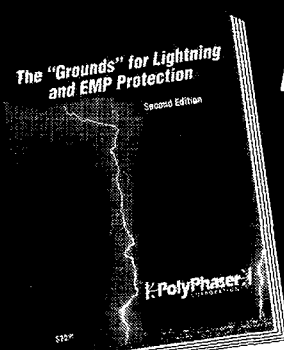
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trailer or controller port that is opened from the TNC menu. Each of these windows has a gray bar at the top, with various combo boxes, buttons, and status windows. Below are two panes with scroll bars, one for received text and messages from the controller—the other for locally typed text. This is where you communicate with other stations, but not with the controller itself. Herein lies one of my wish-list additions to the program. Those of you who, like me, are used to operating controllers in a command-line fashion will probably find yourselves typing things like MH and C AA9FP. These just won't work, since anything you type goes out on the air. I wish that AEA had included a command-line window where direct controller commands could be typed—sometimes command line is just easier.

The initialization process will be familiar to those who are current Pakratt users. A small box shows each parameter's name as it is set. The time required for the process can be greatly reduced by checking the Fast Initialization box in the TNC Configuration dialog.

Controller commands are all sent through the combo boxes and buttons at the top of the window and, to be honest, I would much rather have just these, rather than only a command line. On the left-most side of the

control bar is a combo box to select operating mode. Pressing the down arrow on this box drops down a list of all operating modes available for the controller/port that is active. Choosing one instructs PPWIN to set the controller for operation in the select-

"One of the nicest things about PPWIN is the push-buttons that give you immediate access to your controller's functions."

ed mode, including the modem and shift required. Just to the right of the mode box is another combo box which selects data rate. This works the same way and displays the available rates for your hardware.

A set of push-buttons and a small box directly adjacent to the mode and data rate controls provides a way to select the virtual channel to be monitored. It is possible to select all channels or any particular channel.

Directly below these three controls are the status line and time/date. The status line displays messages appropriate to the operating mode—with information like unack'd and received frames, and the state of the link. The date and time are displayed just below the status. The time appears in UTC (Coordinated Universal Time, also known as GMT—Greenwich Mean Time) to the left, and local 24-hour format time to the right of the date. Two small buttons allow you to select the desired version of the time, whose color switches to red when chosen.

Push-Button Operation

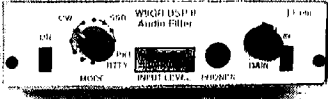
One of the nicest things about PPWIN is the push-buttons that give you immediate access to your controller's functions. Some buttons do something immediate, like the one that turns on the mailbox—AEA's term for mailbox—and the CONPERM button that makes the current connection permanent until you turn it off. Most other buttons produce dialog boxes that give you an easy way to do things that otherwise would require multiple command lines or tedious linear input.

Connect

The Connect button produces a dialog with an editable field, a list box, and six but-

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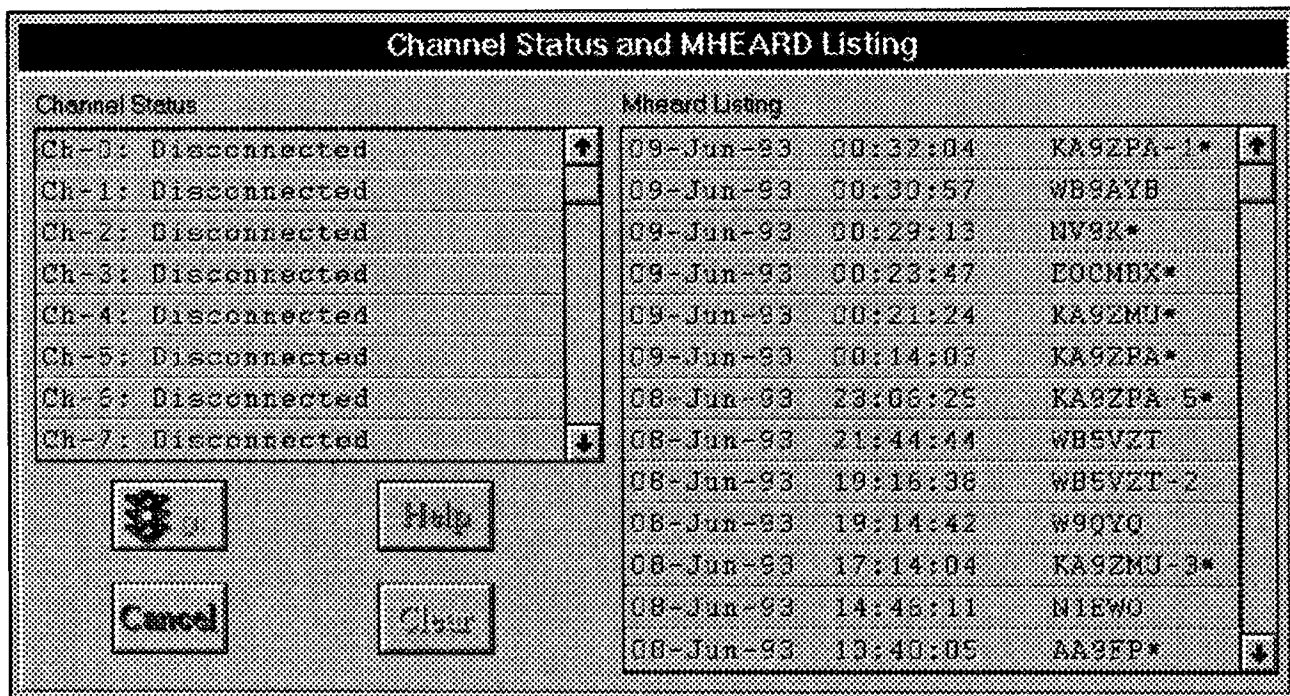


Figure 2. MHEARD dialog box.

tons. The field at the top of the box is where the desired connection gets specified. This can include digipeaters, and the line is specified in the traditional fashion:

N1EWO V AA9FP, EOC, BED (for example)

This is just as a command line would work, but with PPWIN you need only type the connect string once. At that point you can press the Add button, which will add the string to the list box, from which you can select the connection in the future. A companion Delete button allows removal of any strings from the list. The dialog also includes a Disconnect button, should you want to close an existing connection or one in the process of being made. The other three buttons include the usual Close, OK, and Help buttons.

The Help button, as the Help menu option and any other help button in another dialog, launches the standard Windows on-line help system containing the entire manual for PPWIN, as well as a complete listing of AEA controller settings. This is a great feature! Pressing a help button in any dialog produces instant context-sensitive advice—no scrounging through manual pages. As is usual with Windows help, you can search the text for keywords allowing quick and easy access to the information—this feature alone would have value as a separate product.

A companion Disconnect button is located just below the connect button on the main button bar for easy access.

File Transfer

The File Transfer button features a file folder with "XFER" on its side—pretty easy to locate. This button makes moving files

between stations a snap, and not just text but binary (program, data, etc.) files, too. Pressing the button produces a dialog box with several buttons and a list box. A nice feature of PPWIN's file transfer capability is background operation. It is possible to start a file transfer—ASCII or binary—and switch to a different virtual channel to carry on a conversation. This is very convenient, given the relative slow transfer rate of most packet operations.

As with the Connect dialog box, PPWIN maintains a list of file names which can be added to, deleted from, or selected from the list box. Radio buttons—mutually exclusive push-buttons—select send or receive binary, or ASCII transfer modes.

Capture

Text capture, too, is just a button press away—indicated by a right-pointing arrow aimed at a floppy disk. This button produces a simple dialog box with a place to type in a file name (the default name is specified in the configuration menu), a Find button which allows browsing for a specific file, and a pair of radio buttons that select overwrite or append modes.

Printing

A Print button turns on and off capture to the printer. As with all Windows applications, printer setup is on the File menu.

MHEARD List

A button sporting a small ear produces the Channel Status and MHEARD Listing dialog box. This list serves two purposes. First, it shows recently heard stations—just as you'd expect. The surprise is that each entry on the list forms a push-button; push-

ing it—plus OK or Enter—will automatically connect you to that station. This is a great feature—no more scribbling down the info so you can try to connect to a new station that shows up on the list.

This dialog also shows a list of all virtual packet channels, and whether they are currently connected. As with the MHEARD list, selecting a channel from the list allows you to switch directly to that channel.

Maildrop

The Maildrop button makes maintenance easy. Pressing the button, marked with an addressed envelope, invokes the maildrop dialog. This dialog offers a list of incoming messages at the top—a double click will read the message into a pane just below where it can be scrolled using standard Windows scroll controls. Once the message is read, push-buttons offer several options:

Save Message—An editable field specifies the file name, a press of the Save Msg button writes the current message to that file.

Kill Message—The Kill button deletes the message from the Maildrop, just like typing kill {message number} at the command line.

Edit Message—This button invokes a small dialog which allows the editing of various message parameters and status. Three edit boxes offer the From, To, and BBS addresses for editing. Six radio buttons set Private, Traffic, and Bulletin status—as well as Reverse Forward, Read, and Not Read.

A dialog built into the bottom of the Maildrop dialog allows the composition of a message. Fields for Subject and Callsign

specify message parameters. The text is typed into a pane below and edited, or a filename can be specified or browsed as the message.

Macros

PPWIN has so many useful features that I find myself wanting to say, "This is a great feature!" over and over. So, at the risk of repetition—this *is* a great feature. Macros are used by PPWIN in two basic ways. First, there are standard macros for various operating modes. In AMTOR, for example, there is a CQ-AMTOR macro which you edit to contain your personal CQ text. The other type of macro is one you can choose from a listbox by pressing the Macro button from the main bar.

This dialog lets you create your own macros, which can be used to send special text and to control some controller functions. This is not the intention of the macros, unfortunately. To accomplish this, the function that you are interested in must have a keyboard shortcut and you must use a separate editor to get that shortcut as text. As an example, CTRL+F, in AMTOR mode, stops transmitting and sends a Morse ID. To include this in a macro, several steps are required:

1. Launch Windows Write—the Microsoft-supplied word processor. PPWIN

actually makes this easy: It appears on the Tools menu of the main menu bar.

2. While holding the ALT key down, type 06 on the numeric keypad—not the number row of the main keyboard. Then release ALT. CTRL+F has an ASCII value of 6; Windows needs the leading 0. A box will appear in the Write window. This is a place holder for an unprintable character.

3. Using the mouse, carefully select just

"Another thing that PPWIN does to make a ham's life easier is provide a way to easily set all those parms that make or break your station."

the box. Using the copy option from Write's Edit menu, transfer the character to the Clipboard.

4. Return to PPWIN's macro edit Window and Paste the copied CTRL+F in—the SHIFT+INSERT key combo will do this.

You now have a CTRL+F in your macro. While this works, it's no fun. The next ver-

sion of PPWIN needs improvements to the macro capabilities.

All Those Pesky Parameters

On the main menu bar, the Parameters menu offers a way to set parms for each operating mode separately. Each choice provides a dialog with each parm available. Depending upon the nature of the parameter, it can be changed with a push-button, a drop down list, or an editable field—and they are all right there in front of you. To top it off, help is just a button press away. This is not only a great way to set the parameters, but it's a great way to learn them, too.

More and More . . .

As much as I have written about this product, there is more to it. There is a lot of depth to PPWIN, which is really designed to make operations easier. It is not wart-free, but it is, in my opinion, the best way to do digital ham radio I have ever seen, especially when teamed up with a PK-900 or DSP-2232 and their state-of-the-art capabilities. PPWIN will not be everything to everybody, but I can say that I feel a little sorry for those of you who don't own AEA hardware, since you need it to run this great program. If you own a Windows-capable computer and an AEA TNC or controller you have to own PPWIN!



THE POWER STATION

The POWER STATION is a 12V x 6.5 AmpHr gel-cell battery complete with voltmeter, wall charger and a cord for charging via automobiles. It will power most HT's at 5 Watts for 2-4 weeks (depending upon how long-winded you are). Also VHF, UHF, QRP, or HF, mobiles such as the KENWOOD TS-50 (at 60W). There are no hidden costs, all you need is your mobile or HT power cord or cigarette lighter adapter.

The POWER STATION provides 12V from a cigarette plug and has two recessed terminals for hardwiring. A mini-phone jack with regulated 3V, 6V, or 9V output can be used separately for CD players, Walkmans, etc. THE POWER STATION can be charged in an automobile in only 3 hours, or in the home in 8 hours. The charger will automatically shut off when the battery is completely charged, so you can charge it even when it has only been slightly discharged, (unlike Ni-Cads that have memory). Our charging circuit uses voltage sensing circuitry, other brands are timed chargers which always charge the battery a full cycle, this damages their battery and shortens its' life if it only needs a partial charge. The POWER STATION has a voltmeter that shows the exact state of charge of the battery, not worthless idiot lights that tell you "YOUR BATTERY IS NOW DEAD." The voltmeter can even be used to measure voltages of other sources.



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73 Review

by Larry R. Antonuk WB9RRT

The STARTEK ATH-15 Portable Frequency Counter

STARTEK International, Inc.
398 NE 38th Street
Ft. Lauderdale FL 33334
Telephone: (305) 561-2211;
(800) 638-8050 (orders only)
Price Class: \$235

One of the fringe benefits of becoming a ham is watching the evolution of modern electronic technology. We hams have a front-row seat at the electronic stage—and sometimes we even get to perform. For example, it wasn't too long ago that a 2m handheld with frequency switches instead of crystals was a big deal. Nowadays, if you don't have dual bands, 97 memories, full-duplex, an alarm clock, and musical access tones, you're just not up to speed! In any product, if you look closely enough, there is always a spot in time where the engineers obviously accomplished the main goal, and then were able to concentrate on adding "frosting" for making the user more comfortable. Once the product has reached the point of fastest/smallest/most powerful/most sensitive, it starts to get more "humane." These features may take the form of memories or scan functions in our handheld, or more intuitive controls or menus. The radio doesn't really transmit any better than that old rock-bound rig, but it starts to make life easier—which is really the main job of any piece of technology.

This whole concept of "user-friendliness" is more often seen in consumer items—ham rigs, computers, cellular phones—than in

electronic test equipment. This is mainly due to the number of units sold, the profit made, and consequently the dollars pumped back into R & D. In light of this, it's impressive to see a low-cost piece of test equipment that has made the jump over to "user friendly."

It's User Friendly

The STARTEK ATH-15 Pocket Sized Frequency Counter comes from a long line of counters that, over the years, have been getting smaller, and faster, and able to read higher and higher frequencies. The engineers at STARTEK obviously found themselves at the same point as their consumer electronics counterparts. The last model out was certainly small enough—any smaller and you'd have to strap it to your wrist. It counted every frequency that most hams were interested in. There was a full line of accessories. The only other improvements could be in the category of "you know, it would be kinda nice if it did . . ."

The STARTEK engineers took this assignment seriously and came up with two new features that make the ATH-15 not just easy, but actually enjoyable to use.

The first feature actually has

nothing to do with frequency counters. It's an LED bar graph signal strength meter. This 10-segment graph sits near the top of the display, and simply indicates relative field strength. By itself, this is a useful item for antenna testing, foxhunting, or checking for RF leaks around your operating console. Used in conjunction with the counter, it provides an easy way to get a handle on maximizing the input to the counter when using low power sources. Rather than waiting for several counts until things stabilize and hoping for a good reading, you can simply peak the LED bar graph and know that your signal is at max—or relocate the counter or RF source until it is. This combined feature is very useful when playing with flea power transmitters, or snooping on a weak signal. (It should be noted that even though the counter and field strength meter can be used at the same time, they are electrically two separate devices. Some products on the market use a signal derived from the counter's circuitry for a strength indication. This works, but the signal strength readings can be dependent on the gate time of the counter, and whether or not it's in the HOLD mode. The ATH-15 keeps these functions separate, providing a true real-time field strength meter—at no extra cost.)

The second feature is actually several features, but they all culminate in the Automatic Trigger and Hold circuitry. This feature is extremely impressive, especially considering the price tag on the unit. Put simply, the readout will hold and display the last properly received frequency. In other words, keying your portable for a second on channel one will cause that frequency to stay on the display. Flip to channel two and tap the PTT. The display will flip to channel two's frequency—and stay there. This is a great

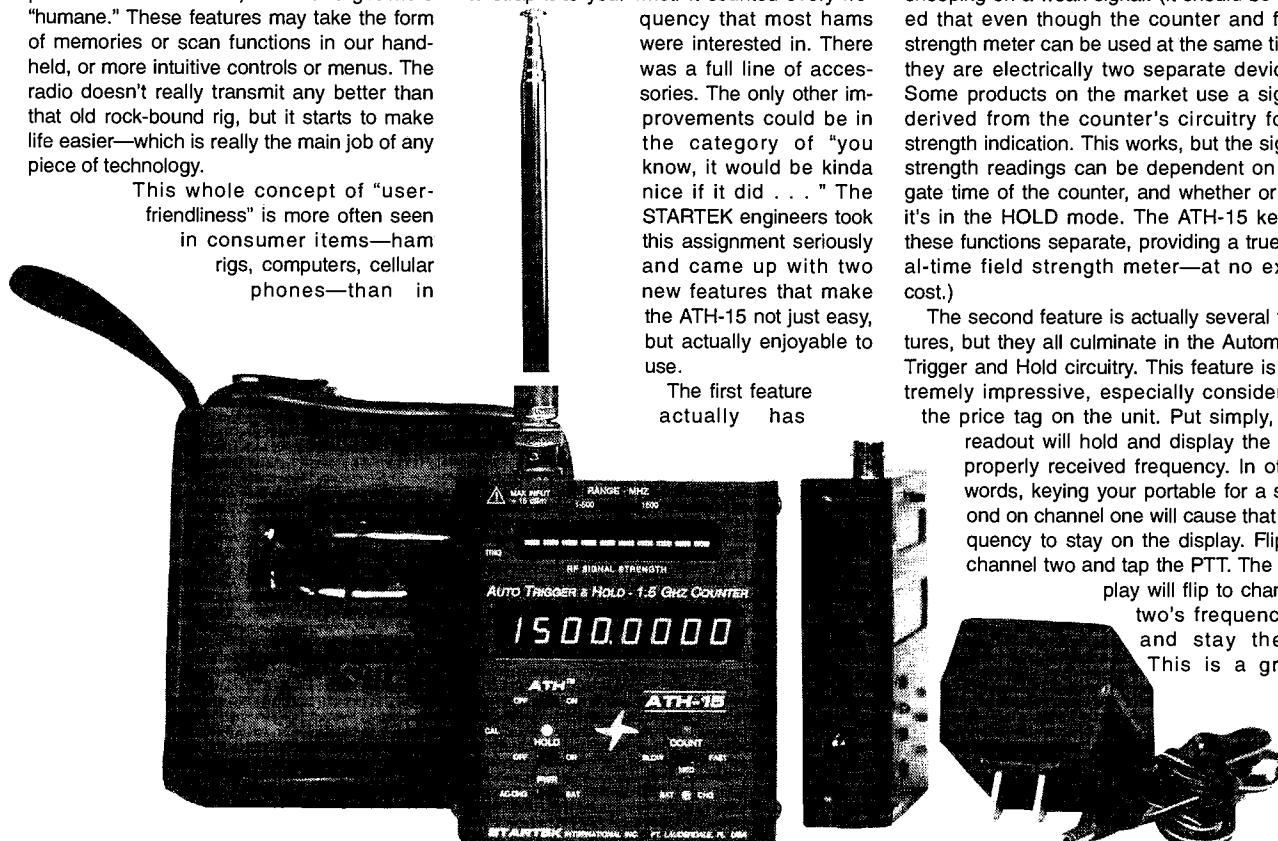


Photo A. The STARTEK ATH-15 Portable Frequency Counter.

function for testing or checking out multi-frequency radios, or counting and storing an interfering frequency. (If the optional "One-Shot Trigger" and "Hold" options are purchased, the ATH-15 will display and lock onto the first readable signal, ignoring any that follow.)

Just as important as the Automatic Trigger and Hold capabilities are the functions that make it possible. The first of these is an amazingly quick count time. The specs say that the unit can read an input signal, display the frequency, and switch to HOLD status in less than 80 milliseconds. In reality, 80 milliseconds seems like the point somewhere between where you decide to push the PTT and where you feel any pressure at all. (Plan on spending the first five minutes with your new counter running around the house, keying up everything in site. When I showed off the review unit to friends and technicians, the common term to describe the response time was "Wow.")

The other feature of importance is the "Automatic Clean Dropout" function. This keeps an eye on the current frequency and compares it to the last count. If the current count is of a shorter duration, the unit hangs on to the last good count without updating the display. This means that the "held" frequency will probably be correct—no "garbage" counts are displayed from when the transmitter was keying.

The ATH-15 is a sensitive unit. Most hand-

helds could be detected out to about 100 feet with no problem, using the standard antenna. The problem with this sensitivity is that the unit is easily overloaded in strong multiple RF fields. This is due to a combination of the unit's 1 to 1500 MHz bandwidth, plus its high sensitivity. Unlike a radio with a tuned front-end, the ATH-15 can be listening to several signals in addition to the one you want to count. In other words, if you want to copy a weak 146 MHz signal at the same time the ATH-15 is hearing a garbage truck on 30 MHz, the police on 155 MHz, a construction company at 450 MHz, and a cellular phone at 850 MHz—well, things can get confusing. This "swamping" is the nature of any broadband device, as any ham who's had his HT at a flea market can tell you. The STARTEK engineers have created a solution to this in the form of a set of three different bandpass filters. These half-inch diameter filters come with BNC connectors, and pop in-line with the external antenna. They filter out the undesired frequencies, while passing the band you might be interested in. The filters are available in 60 MHz low-pass, 400 MHz high-pass, and 800 MHz high-pass configurations. They greatly increase the "effective sensitivity" of the unit, and would be helpful if you tend to do off-the-air monitoring of specific channels or bands. For most general purpose applications the filters won't be needed.

Operation of the ATH-15 is similar to earli-

er members of the STARTEK family. The "Count" switch controls the speed at which the samples are taken. As normal, a slower count time gives you a higher resolution display (five decimal places when counting a 1 to 500 MHz signal in the "Slow" position). The unit has a manual hold switch for locking in a reading, and of course the Automatic Trigger and Hold function can be turned on or off. If the "One Shot" option is purchased, switches on top control the resetting and operation of this mode. Like other models, this unit has two band positions: 1 to 500 MHz, and 500 to 1500 MHz. New features include a low battery indicator and extra bright LED digits.

In addition to the basic unit, STARTEK offers a complete line of accessories including antennas, cases, a high-stability oscillator option, and the bandpass filters. (Due to its size, the ATH-15 will tend to spend a lot of time in the toolbox or on the dashboard. The optional case is highly recommended.) At press time, the ATH-15 was being offered at a promotional price of \$199, and a new model, the ATH-30 (2.8 MHz capability), was introduced at \$259. They come standard with the one-shot feature. Prices include NiCd's and a charger, and a one-year labor, five-year parts warranty. Your requirements concerning range and options might vary, but any of the STARTEK counters represent a great value for your test equipment dollar.

ID-8 Automatic Morse Station Identifier

Compatible with Commercial, Public Safety, and Amateur Radio applications. Uses include Repeater Identifiers, Base Station Identifiers, Beacons, CW Memory Keys, etc. Great for FCC ID Compliance.

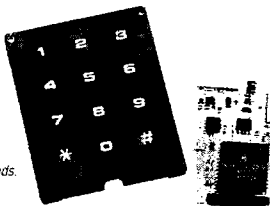
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- Totally RF immune.
- All connections made with micro-miniature plug and socket with color coded wires attached.
- CMOS microprocessor for low voltage, low current operation: 6 to 70 VDC unregulated at 10mA
- MOS distortion: low impedance adjustable sine-wave output: 0 to 4 volts peak to peak
- Crystal controlled for high accuracy
- Transmitter PTT output (to key transmitter while ID is being sent), is an open collector transistor that will handle 80 VDC at 300mA
- Field programmable with SUPPLIED keyboard
- Confirmation tone to indicate accepted parameter, plus tones to indicate programming error.
- All programming is stored in a non-volatile EEPROM which may be altered at any time
- Message length over 200 characters long
- Trigger ID with active high or low
- Inhibit ID with active high or low. Will hold off ID until channel is clear of traffic.
- Generates repeater courtesy tone at end of user transmission if enabled
- Double sided tape and mounting hardware supplied for quick mounting
- Operating temperature range: -30 degrees C to +65 degrees C
- Full one year warranty when returned to the factory for repair
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Programmable Features

- Eight programmable, selectable messages
- CW speed from 1 to 99 WPM
- ID interval timer from .99 minutes
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- CW tone frequency from 100 Hz to 3000 Hz
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\$89.95 each

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73 Review

by Jeffrey Sloman N1EWO

The AEA PK-900

State-of-the-art digital ham radio.

Advanced Electronic Applications, Inc.
P.O. Box C2160
2006 196th St. SW
Lynnwood WA 98036
Telephone: 800-432-8873
Price Class: \$569

The dual-port PK-900 represents the next evolutionary step in AEA's multi-mode controller technology. Unlike the revolutionary DSP-2232, the PK-900 uses traditional modem technology with a few high-tech twists. The PK-900 offers improved ease of use and some changes in the computer-controlled portions of the unit's circuitry.

LCD City

Unlike previous models—even the top-of-the-line DSP-2232—the PK-900 sports a sexy new LCD annunciator panel in place of the traditional LED Christmas light display. This high-contrast, backlit panel is easy to read under most lighting conditions, (with the exception of some occasional glare from reflected light.) One thing that makes this new display particularly useful is that, unlike the LED arrays of previous models, these indicators say just what they mean. The operating mode of either port can be seen from across the room—no more memorizing LED locations or guessing. The display provides a lot of information: operating mode, link state, TX and DCD indicators, various status indicators and, at the bottom of the display, a tuning meter.

Those of you interested in HF modes have, no doubt, spent a lot of time in front of your controller's tuning meter trying to get those LEDs to look just like the picture in the manual. I have, too. To be honest, my first reaction to the new LCD version was not good. It is quite different to use than the LEDs I had come to know. But after I had used the 900 for a while I found the LCD just took some getting used to. It is at least as good, if not better than, its predecessor. At the very least, it is physically wider, making it easier to see.

Note that the 900 display has only fixed annunciators, it does not have the ability to display arbitrary text messages like its DSP-2232 big brother. While this would be very nice to have, it really does detract from the 900's utility.

Also located on the front panel are the traditional threshold control (a nice, big, easy-to-use knob) and the power switch. This knob adjusts the sensitivity of the DCD (Data Carrier Detect) function, and is only functional for port 1. Moving the power to the front is a nice change from the PK-232, the 900's predecessor.

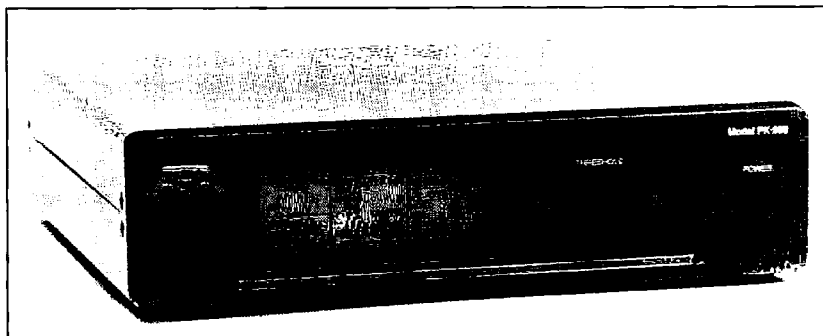


Photo A. The AEA PK-900.

The Back Panel

The back panel of the unit is a pleasant blend of the old and new. The 900 uses the same coaxial power connector as previous models, making upgrading a little easier. A five-pin DIN connector provides output for a tuning scope, and for direct CW keying.

This connector replaces the old RCA jacks for keying, although I'm not sure this is an improvement. The RCA approach was very easy to use.

The two radio ports depart from the PK-232 and more closely resemble the DSP-2232's five-pin DIN connectors. The 232's unusual radio connectors made building a cable somewhat difficult once the AEA-supplied units were exhausted. A pleasing throwback to the 232, however, is the inclusion of two 1/8-inch phone jacks on the rear for audio input. This is great for SWLs who will not transmit with the unit, and for those of you who are like me and just can't wait to see the unit do its stuff.

A fourth DIN connector provides FSK (Frequency Shift Keying) outputs for RTTY fans with radios capable of using them. Both positive and negative keying are available. Transmit level controls for each radio are screwdriver adjustments, also located on the back panel.

The connection from the PK-900 to a data terminal or computer is made through a DB-25 connector which supports pins 1 through 8 and 20. These are the standard pins needed for any sort of RS-232 serial connection. Next to this connector is the unit's reset button, which operates in conjunction with the power switch to reset the 900 to factory defaults.

Four additional trimmers located on the right side of the box allow screwdriver adjust-

ment of the AFSK levels for each radio. The PK-232 had only one, pointing out that the 900 is a true two-port unit, not just able to switch between radios.

What Can It Do?

The specifications of the PK-900 are impressive. The unit will operate in just about any mode that a modern ham could want:

- AX.25 (Packet) HF and VHF
- Baudot RTTY
- ASCII
- AMTOR
- FACTOR
- Morse (send/receive)
- HF Wefax (Weather Fax) in Greyscale
- NAVTEX reception
- TDM (Time Division Multiplex) reception
- Bit-inverted RTTY (encrypted) reception

The PK-900 accomplishes all these modes with some very nice hardware. AEA has always been known for superior HF performance, and the PK-900 incorporates the same eight-pole Chebyshev bandpass filter used in the excellent PK-232 for high frequency operations. This filter means that the 900 should do much better than average with poor signal conditions, an assertion borne out by experience—not just mine; ask around. The 900 has it all over the PK-232 in the modem department, since soft selection of the modems let each mode's precise needs be accommodated.

On the output side, the unit uses a DDS chip (Direct Digital Synthesis) to modulate the radio making it extremely flexible. The PK-900 could produce any sort of modulation you might want, including DTMF or two-tone sequential paging, if the mood struck you. A user program capability makes this feature

available to the hackers among us.

With its optional 9600 baud modem (about \$75), the PK-900 is ready to keep up with the world of packet as it grows. By the time you read this, PACTOR will be a standard feature, no longer an option. Current owners without PACTOR should contact AEA concerning the upgrade.

Dual Port

The big question I hear about the PK-900 concerns its dual-port capabilities. Hams want to know just what it can do with the two ports. Here's the scoop: Radio port one can do anything—any mode the controller is capable of. Port two, on the other hand, is restricted to packet—HF or VHF. This is full simultaneous operation. Unlike the PK-232 whose two ports were selectable by a switch, the PK-900 can keep your VHF packet station on the air while you work AMTOR, or PACTOR, or any other mode on port 1. To me, this is what dual-port ops should be. Keep in mind that AEA's engineers designed this box to be used in the shack, not as a node in a packet network. Its features and capabilities are targeted to that market.

PACTOR

Yes, the PK-900 does PACTOR. This mode is a lot of fun, combining the qualities of packet and AMTOR for excellent weak-signal performance. The PK-900's inherently ex-

cellent HF performance is available in PACTOR mode, too. You will find plenty of PACTOR traffic on 10 and 20 meters. It sounds like an AMTOR station on barbiturates. This mode will probably eventually replace AMTOR, since it works better for most amateur operations.

Using the 900

If you are familiar with AEA hardware, the PK-900 will not present any surprises. The unit's autobaud routine easily sets the data rate at initial startup, reducing a lot of difficulty for new users. The manual provides a thorough section on setup and connection of the unit. Once again I am forced to say that, while AEA's manuals contain lots of information, their organization affects ease of use a little more than I would like. (A diplomatic way of saying I don't care for the manual.) On the other hand it does include the most important information: connector pinouts, schematics, and a complete command summary.

In my opinion, there is only one way to use the PK-900: with AEA's new PC Pakratt for Windows. This program, which is reviewed elsewhere in this issue, makes using the PK-900 a real pleasure. Not only does PPWIN know about every bell and whistle, it also provides concurrent access to the two radio ports—a neat trick. If you can't run Windows, you should seriously consider buying a pro-

gram that knows about the PK-900. There are DOS and Macintosh versions of Pakratt available from AEA, as well as third-party terminal programs that work with the unit. While the 900 can be operated from the command line, it is a complex piece of equipment and will have a very steep learning curve without the computerized assistance.

Performance

What else can I say? The PK-900 performs very well. It is directly comparable to the PK-232. In fact, in side-by-side testing, the two units were indistinguishable. Both showed excellent HF performance—especially noted in poor conditions or with weak signals. VHF performance was stellar as well, but of course it had better be. If a TNC has trouble on VHF packet, something is wrong. If you want some opinions on PK-900 performance, you can ask some PK-232 owners what they think of their controllers—you're bound to find several on the local repeater.

Conclusion

Teamed up with PC Pakratt for Windows and a pair of transceivers, the PK-900 is the heart of a truly state of the art digital ham station. The PK-900 costs a bit more than the PK-232, but the difference in cost is reflected in the capabilities of the box. If the additional outlay doesn't scare you off, you won't be disappointed with the PK-900.

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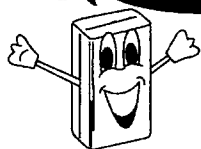
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Julieboard

An easy-to-build DDS synthesizer for the PC printer port.

by Bruce Hodgkinson VESJIL

Every so often, a technology development comes along which radically and permanently alters the landscape of amateur radio—spark to CW, AM to SSB, vacuum tubes to solid-state, and so forth. Each of these new developments has made possible things which could only be dreamed of before, but quickly become taken for granted. The introduction of direct digital synthesis (DDS), a DSP-related technique, has been one such advance in the RF design field. At first, DDS-based gear could be afforded only by the military, but the state of the art has now advanced to the point where new commercial and amateur radio designs include it as a standard feature.

Why DDS?

The best way to answer that question would be to take a look at the disadvantages inherent in the old techniques. Traditionally, VFOs (including those based on phase-locked loops) have employed analog LC oscillators dependent on mechanical and physical characteristics for frequency control. Although analog oscillators are appealing due to their apparent simplicity, they fall prey to the usual analog type bugaboos: calibration error, drift, phase noise, excessive lock-up time, etc. This means that designs which use analog frequency control can—and usually do—lead to alignment, debugging and calibration hassles which then require expensive equipment and time to fix. For those working with phase-lock loops, there is the additional problem of making the frequency resolution vs. lockup time vs. capture/lock range tradeoffs, which invariably compromise performance and/or force the designer to go to multiple loops, mixers, filters, etc.

With DDS, on the other hand, a few chips on a board slightly larger than a business card can implement a wide-band oscillator which gives:

- 0 to 16 MHz coverage
- 0.007 Hz frequency resolution
- Virtually instantaneous switching time
- No drift/no calibration
- Excellent spectral quality
- Simple interface via PC printer port

So, I designed one. This board (which I've named the "Julieboard") is easy to build and is intended for use as a building block to add digital tuning capability to home-brew equipment.

Why the PC Parallel Port?

The first part of this question really asks, "Why the PC?" The DOS computer has made its way to a very high number of amateur stations, doing such jobs as log-keeping, packet radio, word processing, satellite tracking, et cetera. The price has come down to the point where (occasionally) first-generation PCs are actually available free for the taking if one is at the right place at the right time! The software required to drive this oscillator is so simple that it will run on any DOS machine, right down to the humblest one-floppy system, which means that if a PC actually has to be acquired for the specific purpose of running this oscillator, it needn't cost more than a nominal amount.

The second reason for using the PC is that it is a fine platform from which to develop and implement control functions via software: The "front panel" can take any form the user wants, changes can be made at will without having to modify or junk hardware, and functions can be

easily done which would be difficult, if not impossible, to do with dedicated hardware. Rather than being stuck with one hard-wired approach, the user has a software "playground" in which his only limitations are imagination and time available for programming.

Finally, code can be written, modified, and debugged on the same machine on which it runs—allowing the use of widely available and reasonably priced development tools.

The second part of this question is, "Why the parallel port?" Why not do a plug-in (slot resident) version? The first answer is that not all PCs (lap-tops, for example) have plug-in slots available for another board. Also, many PC owners, especially those without a technical background, are not really keen on tearing apart a working system just to install another board which then has to be configured and set up on a particular address location. This is a real problem if the PC belongs to somebody else or the oscillator has to be moved often.

The parallel printer port offers a "plug and play" alternative: Almost every PC has a printer port and few indeed are those computer users who aren't capable of guiding a DB-25 connector onto the end of a cable. Also, a plug-in board approach forces the user to install the oscillator inside the PC itself—which can cause noise problems, as well as impose limitations on where the equipment can go. With the parallel port approach, the equipment can be located a long distance away from the PC and driven via a long extension/ribbon cable for remote operation. Finally, the parallel port, being non-bus-specific, can be replicated with any simple TTL six-bit register. For example, there is no reason why an appropriately programmed single chip microcomputer (such as a Motorola '68705 or Intel '8051) couldn't replace the PC for those who really object to having to drag around a large, bulky PC just to drive a tiny little board. With a single chip microcomputer, an entire HF rig could be made to fit into a shirt-pocket-sized package!

Circuit Description

The circuitry for the Julieboard fits on a small two-layer printed circuit board about 2.5" x 4.5". On one end is the DB-25 connector for the printer cable and the other end has the BNC output and power/external-clock connectors. Power input needs are not critical—anywhere from about +7 VDC to +12 VDC will do. The input is polarity-protected so if the polar-



Photo A. Julie and her board.

ity is wrong, no damage will be done—it just won't work. The incoming DC voltage is regulated down to the +5V level required to run the on-board logic. The only restriction regarding input voltage is to keep it high enough to overcome voltage regulator dropout and low enough to keep regulator power dissipation at a reasonable level. (This circuit draws about 200 mA and the difference between the input voltage and +5V output is dumped as heat at about 200 mW per excess volt).

The largest IC, a 28-pin DIP package (a Harris HSP45102) contains the actual DDS synthesizer logic right up to the sine PROM-output. This device is clocked at a 40 MHz rate by a clock oscillator module and produces a new 12-bit binary word at its output pins every clock cycle. The frequency increment is determined by a pair of internal 32-bit shift registers which are loaded via TTL bit-sequences driven from the parallel port.

The 74HC14 is used as a buffer between the "outside world" and the Harris DDS chip—it provides input signal conditioning and serves as a buffer for the more expensive DDS device. Likewise, the 74F132 performs a conditioning and buffering function between on-board logic and the outside world. It performs an automatic line select function for the external clock: If an external clock signal is applied, the board logic automatically selects that signal, saving the user from having to configure any jumpers.

The output of the Harris DDS chip represents a 12-bit binary sample of the desired waveform at the time of each clock tick; before it can be of much use, this binary output must be converted into an analog voltage. The Harris CA3338 video digital-to-analog converter (a 16-pin DIP package) converts the digital outputs into corresponding analog levels at the 40 million samples per second rate. This level of performance was unheard of several years ago and was one of the reasons why DDS systems were so expensive when they first came out. Things have changed.

The output from the DAC looks like a sine wave made up of little tiny "steps"—256 different levels, to be exact. (One small compromise in this design was made by using an eight-bit DAC rather than a 12-bit DAC, but the four "wasted" binary outputs have such a small impact on the output that the savings in cost easily justified the change. With the 12-bit DAC, the sine wave would be made up of 4,096 different levels of steps.)

"Wait a minute," one might say, "That's noise—I don't want THAT on my transmitter output." Without getting too deeply into sampling theory, let me say that "that noise," is almost completely insignificant. Look at the "made-out-of-little-steps" sine wave again. Think of this as an absolutely perfect sine wave with a superimposed noise consisting of those steps. See how small and how much higher in frequency (than the sine wave) is that noise waveform? It is no problem to filter the noise out—done by the low-pass filter module located on the board.

The filter module implements a seventh order elliptic low-pass filter in a 10-pin SIP package. The space taken by a discrete version of this filter could easily take up half again as much room as the remainder of the circuitry. Since this de-

```

10 CLS:LOCATE 1,1:PRINT
20 PRINT "JulieBoard 200 Controller: JUL200.BAS Apr. 19/93"
30 PRINT
40 PRINT "Options are: 'F' for new frequency"
50 PRINT " 'Q' to quit"
60 PRINT " '<' to increment by 100Hz"
70 PRINT " '>' to decrement by 100Hz"
80 PRINT
90 PRINT "Frequency (KHz) = "
100 GOSUB 220
110 A$ = INKEY$:IF LEN(A$) = 0 THEN 110
120 IF ASC(A$) = 46 THEN GOSUB 310 'decrement for "." key
130 IF ASC(A$) = 62 THEN GOSUB 310 'decrement for ">" key
140 IF ASC(A$) = 44 THEN GOSUB 330 'increment for "." key
150 IF ASC(A$) = 60 THEN GOSUB 330 'increment for "<" key
160 IF ASC(A$) = 102 THEN GOSUB 220 'new F for "F" key
170 IF ASC(A$) = 70 THEN GOSUB 220 'new F for "F" key
180 IF ASC(A$) = 113 THEN 500 'quit if q
190 IF ASC(A$) = 81 THEN 500 'quit if Q
200 GOTO 110
210 '
220 LOCATE 15,1:PRINT "New Frequency (KHz)" ' new F
230 LOCATE 15,21:INPUT NF
240 LOCATE 15,1:PRINT " "
250 IF NF >16000 THEN 220
260 IF NF <0 THEN 220
270 LOCATE 9,39:PRINT " "
280 LOCATE 9,39:PRINT NF:N=NF*1000
290 GOSUB 370:RETURN
300 '
310 N = N - 100:IF N<0 THEN N = 0 ' decr 100Hz
320 GOTO 340
330 N = N + 100:IF N>16000000# THEN N = 16000000# ' incr 100Hz
340 LOCATE 9,39:PRINT " "
350 LOCATE 9,39:PRINT N/1000:GOSUB 370:RETURN
360 '
370 'NX = INT(N* 134.217744#): OUT 888,127 ' phase incr 32MHz
380 NX = INT(N* 107.374195#): OUT 888,127 ' phase incr 40MHz
390 FOR K = 31 TO 0 STEP -1
400 KX = INT(NX/(2^K)):NX = NX - (KX * 2^K) ' bit by bit
410 IF KX = 1 THEN 430
420 GOSUB 490:GOTO 440
430 GOSUB 480 ' shift bit into DDS
440 NEXT K
450 FOR K = 1 TO 32:OUT 888,223:OUT 888,207:NEXT
460 OUT 888,127:RETURN
470 '
480 OUT 888,222:OUT 888,206:RETURN ' shift "1" into DDS
490 OUT 888,223:OUT 888,207:RETURN ' shift "0" into DDS
500 END

```

Figure 1. Simple controller routine written in GWBASIC.

sign is a "building block," why not make it as small as possible?

Driver Software

One of the nice things about using the PC to drive this unit is that a wealth of software development tools are available. The first thing that comes to mind probably would be GWBASIC or some other BASIC interpreter. GWBASIC was used to get the proto-type up and running and a listing of a simple controller routine is shown in Figure 1.

To operate the board, the driver program must drive six DDS control lines:

SDATA* (shift data)
 SCLOCK* (shift clock)
 XFER (new value transfer)
 ENPHACC (enable phase accumulator)
 SHIFTEN (shift enable)
 BANKSEL* (BANK select)

In normal operation, the software holds all four lines HIGH—enabling ENPHACC (allowing the oscillator to run) and disabling/idling the other three (SDATA*, SCLK*, and SHIFTEN). The choice of "HIGH" as the normal state is no accident: This allows the output frequency to be set from the computer, then disconnected from the PC without losing the programming. This

means that the printer port does not have to be tied up permanently—it can still be used to drive the printer while the synthesizer is still in operation by means of a printer switch!

To load a new frequency, the program disables XFER by driving it LOW, enables SHIFTEN by driving it LOW, then shifts in new data by clocking in 64 bits of updated frequency information via the SDATA* and SCLK* lines. Each data bit must be inverted (SDATA* = "0" to shift a "1" into the DDS) and is clocked-in with each HIGH-to-LOW transition on the SCLK* line. The new frequency pair is transferred into the DDS once software re-enables the XFER line by driving it HIGH again. (If this line is allowed to stay active throughout the shift process, there would be 31 periods during which the output frequency would be set to a bogus value, possibly causing interference far off-band).

If desired, the oscillator can be disabled by setting ENPHACC LOW, though this is not critical.

Selection between the two banks is done via the printer port STB* line. This is an open-collector line, so it can be driven from external equipment or from the PC. The PC can read the status of this line, so it can respond to external events via software. For example, a pair of frequencies could be programmed: one frequency

Continued on page 44

Julieboard

Continued from page 42

for "mark," the other one for "space," then keyed to send RTTY.

In a transmitter VFO application, RIT or split frequency operation can be implemented by loading the appropriate transmit and receive frequencies into their respective banks. (This is a good example of software being used to replace hardware.)

If an external line drives this input, it should be a TTL open collector driver so that it does not cause or suffer damage if the computer should drive the line LOW. This "wired-OR" scheme (where if one source or the other or both drive LOW, the line gets dragged LOW) implements an internal drive/external drive scheme which requires no hardware configuration or setup.

Constructing the Hardware

The circuit is not difficult to duplicate and can easily be built with wire-wrap. Because high frequencies are involved, it must be built with the proper techniques or it will not work at all! If you are not familiar with high-speed logic, a commercially fabricated blank PCB or a wired-and-tested board (available from the author) is probably the safest approach.

A high quality circuit board with a low-inductance ground is an absolute must—my standard technique is to use prototype boards with the fat copper strips running up the IC center lines and bridge the strips crossways with a cross-grid built up out of solder-saturated SOLDER-WICK laid along the board. Don't even think of using one of those copperless "protoboards." Plan the layout ahead of time to leave room for the IC sockets and decoupling capacitors.

The IC sockets must be high quality machined gold contact types—the cheap leaf types are not suitable due their high profile (needless lead inductance) and poor reliability. I have often seen them fail, but I've never seen a gold machined contact fail yet. They are expensive (often costing more than the chips they hold), but they are cheap aggravation insurance.

Place the sockets in their final resting places and wire in their ground pins. These must be near zero in length and the widest practical width. My usual practice is to dedicate the bottom-side copper strip (running up the center of the IC pin-rows) to ground and solder the IC ground pins directly to that.

After all, the IC socket's ground pins have been hooked up and the decoupling capacitors have been installed. Decoupling capacitors MUST be placed at the power supply pins of the HSP45102 DDS chip (8,22), the CA3338 video-DAC (13,16), the clock module (14), and the 74F132 (14). The 74HC14 is not a high-speed part, but it should be decoupled also. Keep the leads of the decoupling caps short—the body of the capacitor should just about touch the power pin being decoupled! An eighth-inch lead length is too long. On the DDS chip, the IC designers conveniently placed a ground pin immediately adjacent to each power pin so that the decoupling caps can exactly bridge power/ground with zero lead length—this dictates the use of capacitors with 0.1" lead spacing. Use 0.1 μ F as specified—don't try to "improve" the decoupling by

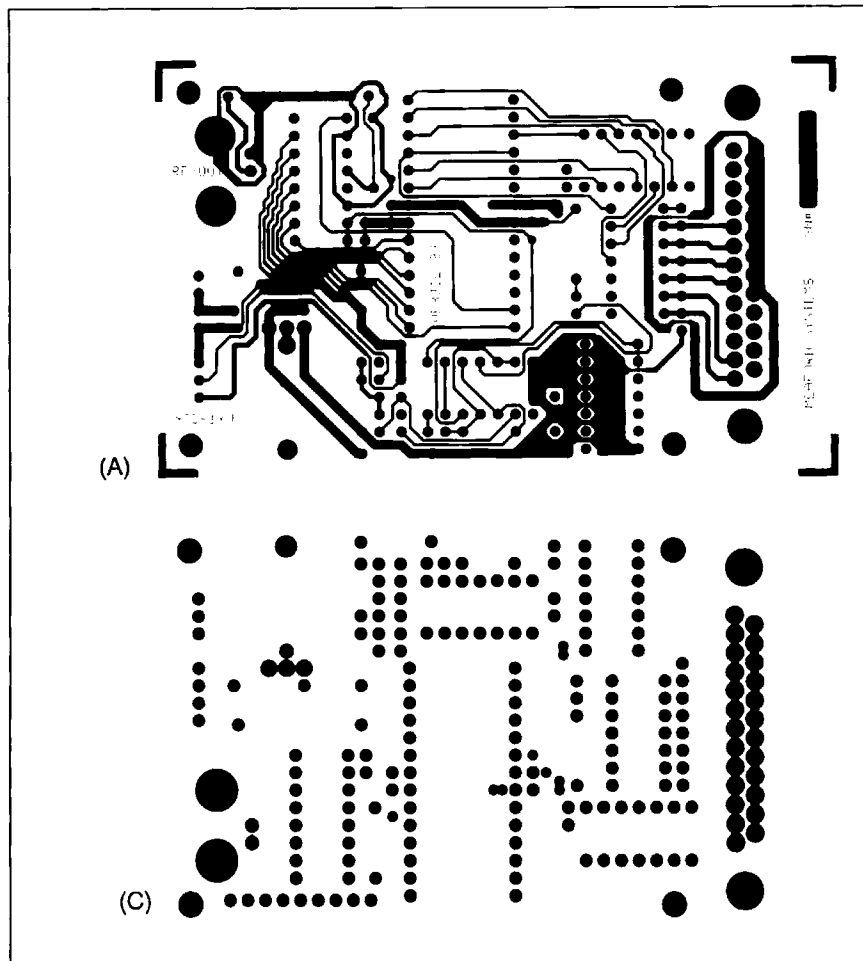


Figure 2. A) PC top foil pattern; B) PC bottom foil pattern;

using higher values of capacitance: Higher capacitance values tend to be more inductive and have a lower self-resonant frequency. Above its self-resonant frequency, a capacitor looks inductive and could make the situation worse than if it weren't there! Once the decoupling caps are installed, wire up the +5V bus to the sockets. At this point there should be virtually infinite DC resistance between the +5V and ground lines.

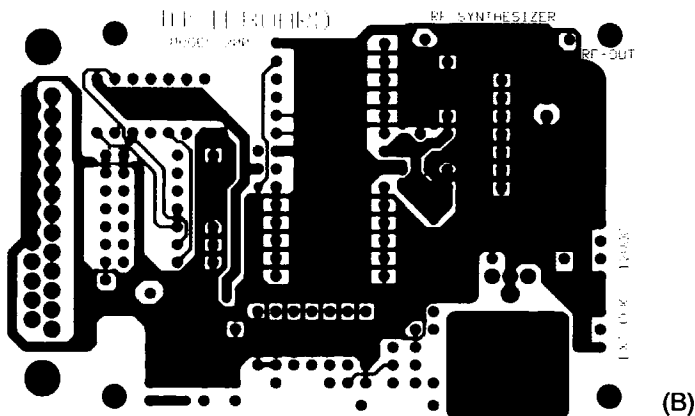
Next, install the 7805 regulator and its diodes. A heat sink with thermal compound on the regulator is a must, as it will dissipate about 1-1/2 watts with +12V input and can get hot to the touch. If you know for sure that the input voltage will always be +12V, a 22 ohm 2W series resistor can be placed in the power input line to help drop the voltage and decrease regulator dissipation. My usual rule of thumb: If I can't hold my finger on a heat-dissipating device, it's running too hot.

When building something, it is wise to take a "divide-and-conquer" approach by doing the project stage-by-stage and testing it after each round of construction. This is a good time to make the first test—better to fry one cheap regulator now than a board filled with expensive parts later! Apply power to the unpopulated board and confirm that the regulator output equals +5V and that +5V appears at all power

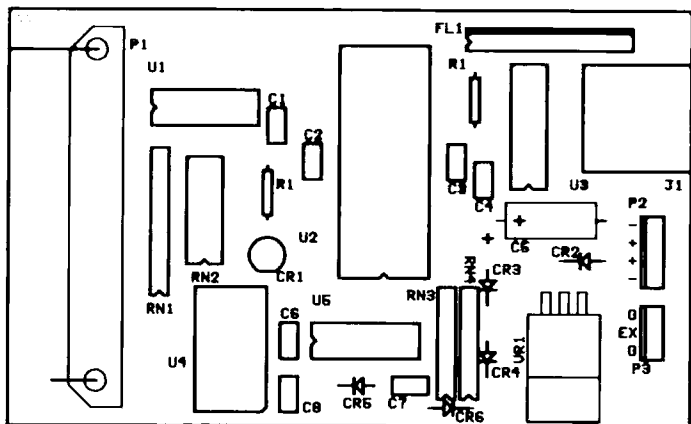
supply pins and 0V shows up at all ground pins. Check resistances between the ground pins with an ohmmeter to confirm that all "ground" pins are indeed tied to ground. Now, install resistor networks RN1 and RN2 along with U1 and wire up all the signals involving these devices, right up to and including the DDS chip, U2. In the breadboard version, I wired up diagnostic LEDs to the outputs—a great aid for software development and for verifying that the right LPT port is being used to "talk" to the board. Power up the board and probe U2 pins 9, 10, 12, 13, 14, and 17—all of which should be a logic LOW. U2 pins 11 and 18 should be HIGH. Short the following DB-25 pins one by one to ground and look for these responses:

DB25, pin 1	U2, pin 9 goes HIGH
DB25, pin 2	U2, pin 13 goes HIGH
DB25, pin 6	U2, pin 14 goes HIGH
DB25, pin 7	U2, pin 17 goes HIGH
DB25, pin 8	U2, pin 12 goes HIGH
DB25, pin 9	U2, pin 10 goes HIGH

The next phase requires an HF receiver and a PC running the Julieboard driver software. Wire up the oscillator module and install U2. (Bear in mind that the DDS chip is specified as being ESD-sensitive by Harris and can be damaged or even destroyed by improper handling. If possible, handle this chip only at a properly equipped



(B)



(D)

C) PC drilling template; D) parts placement diagram.

ESD-protected workstation with wrist straps and an anti-static worktop.)

The 74F132 NAND gate U5 and its associated parts may be installed now.

Connect the PC to the Julieboard DB25 female connector via an appropriate cable (male DB25/male DB25 straight-through) and power up the board. Select a test frequency (this isn't critical, any frequency between 1 MHz and 16 MHz will do) and tune the receiver (CW or SSB mode) to that frequency. A clear continuous carrier should be audible fairly close to the expected frequency. (Use a short piece of wire in close proximity, but not touching, the board as the antenna for the receiver). Try tuning the signal in

100 Hz increments and listen for the corresponding changes in pitch. If it works . . . congratulations, you're almost there! If not, look for activity on U2 output pins 27-28 and 1-6: If they are completely dead, try verifying the presence of the 40 MHz TTL clock at U2 pin 16 and confirm proper U2 hookup. Check that:

VCC	pin 22 = +5V
VCC	pin 8 = +5V
BANKSEL	pin 9 = LOW
ENPHACC	pin 12 = LOW
LOAD*	pin 18 = HIGH
GND	pin 7 = GND
GND	pin 15 = GND
GND	pin 21 = GND

Try feeling the case of the DDS chip. If it is very hot, the problem likely involves the DDS chip itself; if it is stone cold, the problem could either be a faulty clock module or a dead DDS chip. A normally working DDS chip should be slightly warm—if this is the case, suspect a problem with the programming or control process. (Also check to see if it is getting +5V!).

Once DDS chip operation has been verified, wire and populate the CA3338 video DAC (U3) and the filter module (FL1) sockets, observing the same ESD precautions as for U2. The synthesizer output should look like a perfect sine wave, except for low frequencies which will show some "staircasing," courtesy of the D/A conversion process. Finally, verify the EXTERNAL CLOCK function with an external clock—if it works OK, then the construction of the synthesizer is complete. Have fun with the new toy!

Conclusion

I have had computer-controlled DDS synthesizers in my shack for several years now and would almost rather give up my scope or multimeter than do without them—they were well worth the development cost. So far, they have been used for:

- Frequency spotting
- Software-controlled VFO
- VFO for home-brew direct conversion receivers
- Digital retro-fit to analog equipment
- Remote tuning of transmitters/receivers
- Frequency-hopping/spread spectrum work
- Programmable secondary frequency standard
- Crystal/crystal-filter characterization
- Crystal oscillator substitution
- ATE signal generator/sweeper

I found that direct conversion receiver circuits worked especially well with this oscillator—tuning via software on the computer screen was a real novelty and the sound was particularly crisp and clear. Perhaps the next challenge will be a home-brew digital transceiver!

Personal Note

Why "Julieboard"? Well, back when I did my first DDS-for-a-PC design (this is my third), I needed a name for the project. At the time, my second-oldest daughter, Julie, was in her active toddler phase and the name seemed appropriate for a board originally intended for frequency hopping development work. Since I have three other daughters, I suppose I'll have to do at least three other boards so that Julie's sisters don't feel left out!

Continued on page 46

Parts List			
Quantity	Part	Description	Digikey #
1	U1	74HC14	MM74HC14N
1	U2	Harris HSP45102	PC-40
1	U3	Harris CA3338AE	CA3338AE
1	U4	40,000 MHz osc. module	CTX120
1	U5	74F132 (can sub 74F00)	(74F00PC)
1	VR1	7805 regulator (TO-220)	AN7805
1	FL1	Coilcraft filter module	K9686-5
1	CR1	Green light emitting diode	P309
2	CR2,CR6	1N4001 diode	1N4001GI
3	CR3-5	1N914 diode	1N914APH
1	R1	1K5 5% 1/4W resistor	1.5K0
1	R2	75R 5% 1/4W resistor	750
1	RN1	47k resistor network (8sip7)	Q7473
1	RN2	100R resistor network (14dip7)	760-3-R100
1	RN3	1K5 resistor network (8sip4)	Q4152
1	RN4	100R resistor network (8sip4)	Q4101
7	C1-4,C6-8	100N ceramic cap (.1" L.S.)	P4917
Quantity	Part	Description	Digikey #
1	C5	1U0 aluminum electrolytic cap	P1345
1	J1	Right angle BNC connector	Mouser #177-3138
1	P1	Female DB25 right-angle connector	425F-ND
1	P2	4x1 male header	WM4202
1	P3	3x1 male header	WM4201
1		Blank printed circuit board	
1		heat sink	#HS106-ND
1		thermal compound	
1		male/female DB25 cable	C7MMT-2510G-ND
Note: J1 is AMP # 228686-1 P1 is AMP # 745353-4			
Optional:			
1	U2	28p machined (gold) IC socket	AE7228
1	U3	16p machined (gold) IC socket	AE7216
3	U1,U4-5	14p machined (gold) IC socket	AE7214

Blank printed circuit boards, partial kits, and finished units are available from the author (Box 232, Pakenham, Ontario, CANADA K0A 2X0; (613) 624-5247).



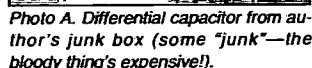
Last month we introduced the topic of variable capacitors by showing two different types: straight line frequency and straight line capacitance. We examined their different styles of construction. We also looked at two-section capacitors and how they are used to tune doubly-tuned RF circuits and the RF/O circuits of superheterodyne radio receivers. In this month's column we will take a look

Two special forms of air variable capacitor are the split-stator and the differential. The symbols for these devices are shown in Figure 1. The split-stator (Figure 1A) uses a common set of rotor plates, but two sets of stator plates. In other words, it is similar to a two-section variable, but with a common set of rotor plates rather than two sets. The capacitances of each section of the split-stator

The circuit in Figure 2B is an RF bridge that can be used to measure antenna impedance, or at least the resistive component of antenna impedance. The bridge is balanced when the ratio of the two halves are equal, or when:

(where Z is the unknown impedance). Resistor R1 is generally set to the system impedance, typically 50 ohms or 75 ohms. In most amateur radio applications it is permissible to use a 68 ohm resistor for R1 in order to accommodate both 50 ohm and 75 ohm systems with only a small error in each. Resistor R1 must be a non-inductive type, such as carbon composition or metal film. Excitation is provided by a signal generator applied to J1.

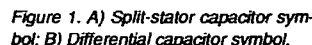
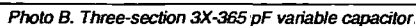
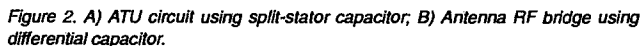
Other applications for capacitors such as the one pictured in Photo B are found where all three sections are connected in parallel. For example, the loading control of pi-network output tank circuits (used in vacuum tube final RF amplifiers in transmitters), often require 800-1200 pF of capacitance. The RF voltages are quite low.



because the output impedance (50 ohms) is low, so it is not necessary to use wide "high voltage" spacing for the loading control (in most cases . . . always calculate for any given power level and allow a margin). Another 3X parallel situation is found in LF and VLF receiving antenna loops where high capacitance is needed. Also, some transmitting loops, as well as many receiving loops, use a single turn input/output loop (depending on point of view, RX or TX) to couple a multi-turn loop antenna to the rig. The multi-turn loop can be resonated with a relatively small capacitance, but the single-turn coupling loop typically wants to see a very high capacitance.

Photo C shows a "transmitting variable" that can be used in high power (2 kW) RF power amplifiers and antenna tuning units. What makes this a "transmitting" variable is the wide spacing between the plates. Wider spacing means that the breakdown voltage of the air insulator between the plates is increased. But wider spacing also reduces capacitance, so the plates tend to be larger and more numerous than in smaller capacitors of the same value.

Perhaps the ultimate in transmitting variables is the vacuum capacitor shown



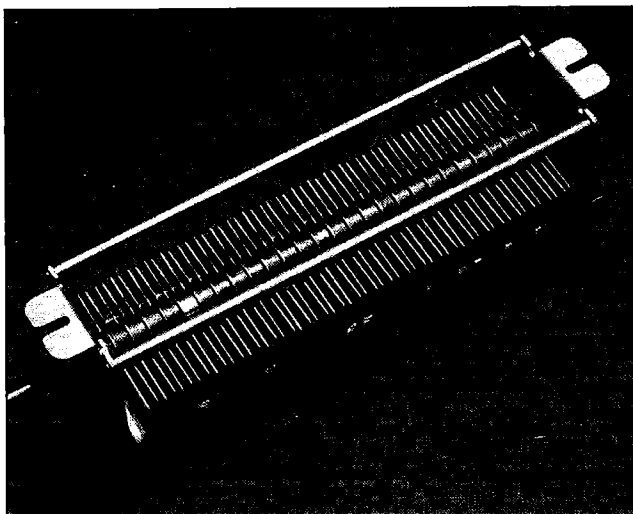


Photo C. Transmitting air variable capacitor.

in Photo D. Although vacuum variables tend to be quite high-priced, I bought this 10-1,000 pF unit from Fair Radio Sales (see Table 1) for less than \$40 a couple of years ago. This particular capacitor is fitted with a small DC motor and a reversing relay. The capacitor is tuned by operating the motor, although it appears that removing the motor apparatus would make it possible to directly tune the capacitor.

Calculating the Tank Circuit Component Values

When we design an RF LC tank circuit it is usually for a specified band of frequencies. For example: 3,500 to 4,000 kHz for the 75/80 meter band (we actually want to tune a small overlap, so 3,490 to 4,010 kHz is what we'll use). We need to know what values of inductor and trimmer capacitor to use with specified main tuning capacitors. We first select a trial variable capacitor for the main tuning job. Look in a catalog for the minimum and maximum capacitances. For this example, I selected a Hammarlund MC-100-M from Ocean State Electronics (see Table 1) with a capacitance range of 7.7 to 100 pF. Refer to Figure 3 as you use this procedure:

Barker & Williamson
10 Canal Street
Bristol PA 19007
(215) 788-5581 (voice)
(215) 788-9577 (fax)
Transmitting variables.

Fair Radio Sales
1016 E. Eureka
Box 1105
Lima OH 45802
(419) 227-6573 (voice)
(419) 227-1313 (fax)
Transmitting and receiving variables (mostly surplus).

Ocean State Electronics
P.O. Box 1458
6 Industrial Drive
Westerly RI 02891
(401) 596-3080 (voice)
(401) 596-3590 (fax)
1-800-866-6626 (voice/orders only)
Transmitting and receiving variables (a lot of "new/old" material, i.e. capacitors that are unused, but of older construction).

Table 1. Variable Capacitor Suppliers

Oren Elliott Products, Inc.
128 W. Vine St.
P.O. Box 638
Edgerton, OH 43517
(419) 298-2306 (voice)
(419) 298-3545 (fax)

Manufacturer, wholesaler, and retailer of all sizes of transmitting and receiving variable capacitors, variable inductors, and vernier drives. Price list of standard products is available.

Maplin Electronics
P.O. Box 3
Rayleigh, Sussex, SS6 8LR
ENGLAND
+44 (0) 81 523-5977 (voice)
+44 (0) 81 523-4879 (fax)

Receiving variables, both UK and USA standard values.

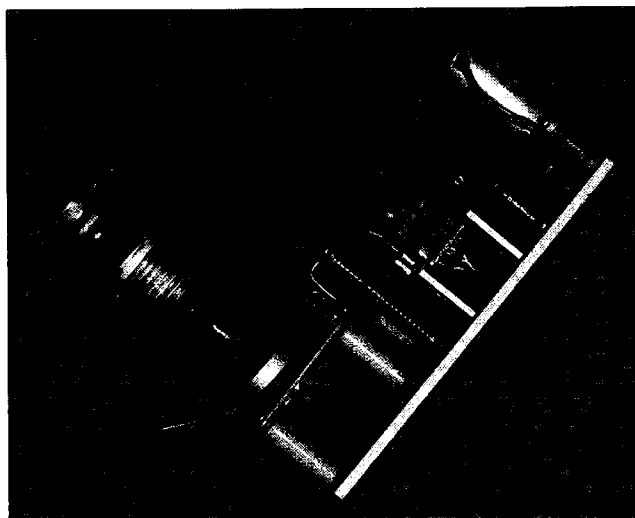


Photo D. Vacuum variable (10-1000 pF) capacitor.

1. Determine minimum and maximum capacitance of C1 (7.7 - 100 pF).
2. Calculate ΔC : $C1_{\max} - C1_{\min} = 100 \text{ pF} - 7.7 \text{ pF} = 92.3 \text{ pF}$.
3. Determine the required frequency ratio (F.R.):

$$\text{F.R.} = \frac{F_{\max}}{F_{\min}} = \frac{4010 \text{ kHz}}{3490 \text{ kHz}} = 1.15$$

4. Calculate the required capacitance ratio (C.R.) by squaring the frequency ratio:
 $\text{C.R.} = (\text{F.R.})^2 = (1.15)^2 = 1.32$

5. Calculate the minimum total capacitance from:

$$C_{\min} = \frac{\Delta C}{\text{C.R.} - 1} = \frac{92.3 \text{ pF}}{1.32 - 1} = 288.4 \text{ pF}$$

6. Calculate the maximum total capacitance:

$$C_{\max} = C_{\min} + \Delta C = 288.4 \text{ pF} + 92.3 \text{ pF} = 380.7 \text{ pF}$$

7. Calculate the inductance by selecting either maximum or minimum capacitance, and the lowest or highest frequency (as indicated by the capacitance value selected). I selected the maximum capacitance (380.7 pF) and minimum frequency (3,490 kHz) combination:

$$L = \frac{10^6}{4\pi^2 F_{\min}^2 C_{\max}} \mu\text{H} = \frac{10^6}{(4\pi^2)(3,490,000\text{Hz})^2 (3.807 \times 10^{-10}\text{F})} = 5.46 \mu\text{H}$$

You can check the calculation with the normal resonance formula (below) to see if the correct frequencies are obtained at the minimum and maximum total capacitance (which correspond to the minimum and maximum values of C1 plus other capacitances in the circuit). The calculations should be accurate to within rounding errors (my calculator showed 3489+

and 4009+ kHz). The resonance equation is:

$$F = \frac{1}{2\pi \sqrt{LC}}$$

Where: F is in hertz, L is in henrys, and C is in farads.

In actual practice you will use a trimmer capacitor (C2 in Figure 3), and possibly a fixed capacitance (C3), to make up the difference between the required capacitance and the values obtained from C1. For example, we need a minimum capacitance of 288.4 pF, but C1 has a minimum of 7.7 pF. Thus, we need a total of 288.4-7.7, or 280.7 pF. The

trimmer should have enough range to account for any tolerance errors in calculation and the values of the parts. I selected a trimmer with a range of 8 to 100 pF, with the idea of setting it approximately in the middle of the range (or about 46 pF \pm a little bit). Thus far, of our required 280.7 pF, we've accounted for 7.7 + 46 pF, or 53.7 pF. We need to find an additional 227 pF. By using a 220 pF fixed capacitor at C3, we leave 7 pF for strays. In some RF circuits this is a reasonable value for strays, and the range of C2 (the "little bit" part) can make up for errors. In some Colpitts and Clapp oscillators, however, there is a tremendous capacitance contributed by the capacitive voltage divider feedback network, so these calculations are wrong for that case.

Sources of supply for variable capacitors include hamfests (but look out for the "sharks" who have inflated ideas of their capacitor's worth—"a crudded up transmitting variable is not worth anywhere near the high price commanded by a shiny new one . . . at least to me"). Table 1 lists some of the places where I've bought variable capacitors in the recent past. The listing for Maplins in England can be used for Americans . . . they accept Visa and Mastercard. The bank card companies will convert the price from £ to \$. Be a little careful reading the Maplin catalog, by the way . . . cost more than \$ (\$1.52/£ as of this writing), so the actual price is higher than it appears in the listing.

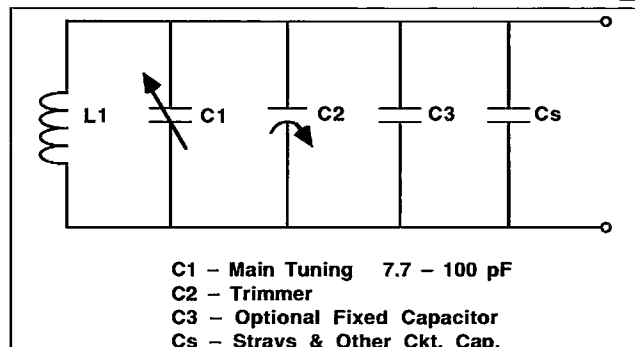


Figure 3. L-C resonant tank circuit for example calculations.

In Memorium

**JA1MP
SAKO HASEGAWA**

March 10, 1929 to June 12, 1993

Founder, Chairman of the Board

Yaesu Musen Co., Ltd.

Tokyo, Japan

As an electronic engineer and amateur radio experimenter, Mr. Hasegawa introduced Single Sideband Radio telephony to amateur bands in Japan in 1956. He constructed SSB generators based on the works of his contemporaries in the U.S., and soon had many requests for complete transmitters and receivers. In 1959 he incorporated Yaesu Musen Co., Ltd. to meet the demand for this equipment. From his inspiration and under his guidance, the company developed the FT-101 transceiver which revolutionized amateur radio. His spirit of innovation and engineering excellence continued with the development of Yaesu's flagship transceiver, FT-1000, that has set a standard by which other top flight transceivers are compared. Mr. Hasegawa was known throughout the company as a hands-on president, taking personal interest not only in the lives and work of each of his employees, but in everyone who chose to use Yaesu equipment.

His call sign, JA1MP became well known in many countries. He was awarded the first Japanese RTTY WAC award in 1971, and remained active in amateur radio and associated activities throughout his life. During the 1980's he co-founded and served as president of the Japan Amateur Industry Association.

As a testimony to Mr. Hasegawa's pioneering spirit and interest in technological advancement, Yaesu has become a leading manufacturer of radio communications equipment throughout the world.

YAESU U.S.A.

Cerritos, California

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

ARSENE Is Up!

A new satellite has joined the growing assembly of active amateur-radio spacecraft. In a spectacular night launch from Kourou, French Guiana, ARSENE and ASTRA 1C were sent to orbit on May 11th riding an Ariane 4 rocket. While the launch went well, the new ARSENE hamsat has had difficulties with the VHF, 2 meter transmitter. Fortunately the satellite also has a SHF, 13cm transmitter and has been available for ham activity since early June.

The Long Road to Orbit

ARSENE is an acronym for Ariane Radio-amateurs Satellite ENseignement Espace. The program began 15 years ago through the efforts of three groups in France: RACE (Radio Amateur Club de l'Espace), ENSAE (l'Aeronautique et de l'Espace), and CNES (National Center for the Study of Space).

Many technical schools, universities and companies joined the partnership to get ARSENE in orbit. The design and construction of the spacecraft involved over 300 students and donations of time, money and components to build the satellite and prepare a ground station for spacecraft control.

The primary goal of the ARSENE program is to provide a satellite for amateur radio operators to use for experimental communications. The program is also devised to contribute to educational programs for satellite design and

telemetry studies. When launch day finally arrived, thousands of individuals had a stake in the mission.

The Launch Campaign

The rocket used to send ARSENE to space was provided by Arianespace and marked the 56th Ariane launch vehicle. The launcher was first prepared for flight in December 1992 to carry a Hughes communications satellite. The Ariane 4 rocket was configured with two solid-rocket, strap-on boosters. The launch was canceled due to technical concerns by Hughes. The rocket was moved back to the preparation area and re-configured for two strap-on, liquid-fueled boosters (42L configuration).

The Ariane launcher stands over 55 meters and weighs 362 metric tons at liftoff. It is a three-stage rocket using exotic fuel, asymmetrical dimethyl hydrazine with nitrogen tetroxide, in the lower two stages and liquid hydrogen and oxygen in the third stage. This configuration was designed to take nearly 3,000 kg of payload to a geostationary transfer orbit (GTO) with an apogee, or high point, of 36,000 km and a perigee, or low point, of 200 km.

The countdown on May 11th proceeded smoothly. Launch was nominal and all systems performed well. Both payloads were delivered to GTO and released to the customers; BETZDORF of Luxembourg for ASTRA 1C and RACE for ARSENE.

The Payloads

The main payload for flight V-56 was ASTRA 1C. It is the third spacecraft in

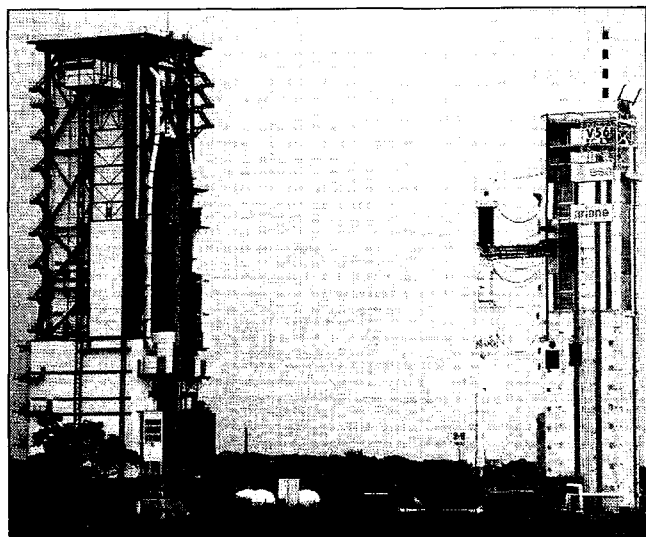


Photo A. The Ariane 42L launch vehicle with two strap-on liquid boosters in preparation for launch from Kourou, French Guiana, May 11, 1993. (Arianespace photo.)

the direct-to-home European TV satellite fleet. ASTRA 1C weighs 2790 kg. and can carry 34 TV channels through 18 transponders. Stabilization is three-axis and available power is 3300 watts from the solar panels at the end of the satellite's estimated 15-year life.

By comparison, ARSENE is very small at only 154 kg. The craft is spin-stabilized, has an estimated lifetime of three years with an estimated end-of-life power of 42 watts provided by a sheath of gallium-arsenide solar cells. Compared to most hamsats however, ARSENE is large, complex and powerful. It was designed to carry a Mode "B" digital communications system using standard AX.25 packet on three separate 70-cm uplinks to a single two-meter downlink. A second transponder was designed for linear operation using Mode "F" (like Mode "S" on AMSAT-OSCAR-13, but with a downlink 46 MHz higher). The uplink is 16 kHz wide and centered on 435.100 MHz with a downlink centered



Photo B. Liftoff of the Ariane 42L launcher from Kourou, French Guiana, with ARSENE and ASTRA 1C on May 11, 1993. (Arianespace photo.)



Photo C. The ARSENE satellite undergoing final checkout.

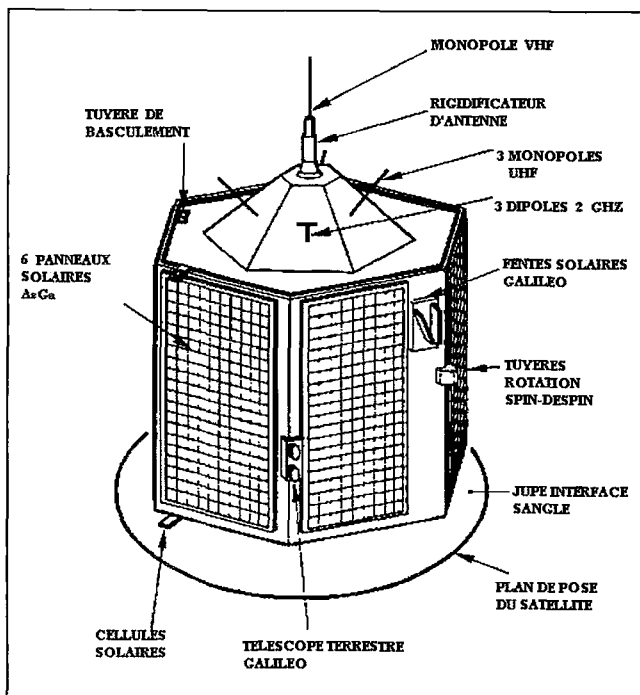


Figure 1. External ARSENE configuration.

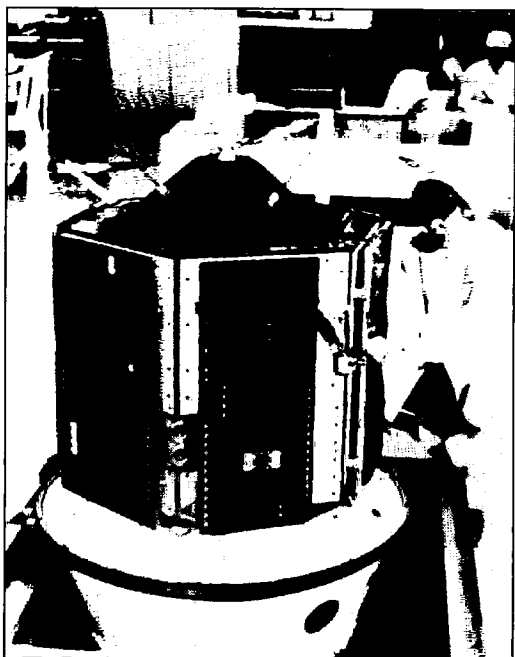


Photo D. ARSENE in final preparation prior to launch.

on 2446.540 MHz. High-speed CW telemetry is sent on 2446.470 MHz.

The Problem

An amateur radio monitoring station on Reunion Island in the Indian Ocean off the east coast of Africa was the first to be in range of ARSENE after release to GTO. The 2 meter downlink signal on 145.975 MHz was expected but not heard. A second Reunion station also reported no signal.

Fortunately the S-band transmitter was working and the ARSENE control station FF1STA in France could receive telemetry on their 7 meter dish. Preparations were made to fire the onboard booster rocket to raise the dangerously low perigee to the desired height of 20,000 km.

Several theories have been suggested concerning the silence of the 2 meter transmitter. The most probable cause is a break in the cable from the transmitter to the antenna or perhaps serious antenna damage. Signals have been detected on the 2 meter downlink, but are so weak that only serious moonbounce stations have reported reception. The designers and builders in France will continue searching for explanations and possible cures.

It's Time for S-Band

Rather than mourn the loss of ARSENE's two-meter transmitter, many stations have begun modifying and upgrading their home stations to work with the new satellite on Mode "F." Any station capable of 500 to 1000 watts EIRP on 435.100 MHz can hit the uplink. A 50-watt transmitter to a 10-dB gain antenna will work. For the downlink on 13cm more effort is required. While A-O-13's S-band transponder can be heard on a two-foot dish with appropriate preamps and converters, ARSENE cannot. The signals are nearly 10 dB down from A-O-

13 levels. This means that a six-foot dish is needed, or some other array with similar gain. The downlink frequency may require some modifications to existing S-band receive converters due to the 46 MHz difference with A-O-13's downlink.

Articles in recent issues of the AM-SAT Journal by Ed Krome KA9LNV and James Miller G3RUH show some ideas on S-band gear for A-O-13 and ARSENE. Ed also wrote "Elementary Mode S" in the March 1991 issue of 73 describing some of his efforts to get results without pain at 2400 MHz.

Companies that provide receive converters and preamps include Down East Microwave (Bill Olson W3HQT) at (207) 948-3741 and SSB Electronics (Jerry Rodski K3MKZ) at (717) 868-5643. For ARSENE reception, adapted six-foot or

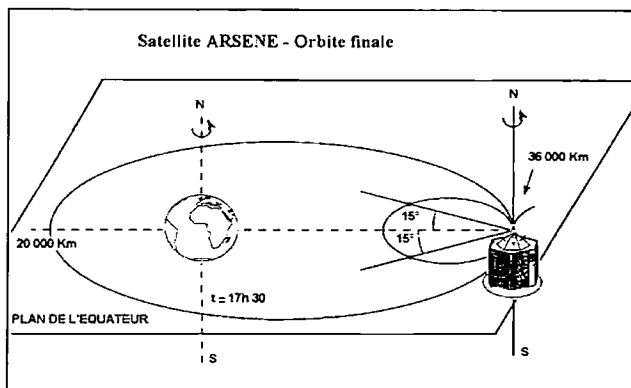


Figure 2. Sequence of events following separation from the Ariane launcher from the geostationary transfer orbit to the final orbit.

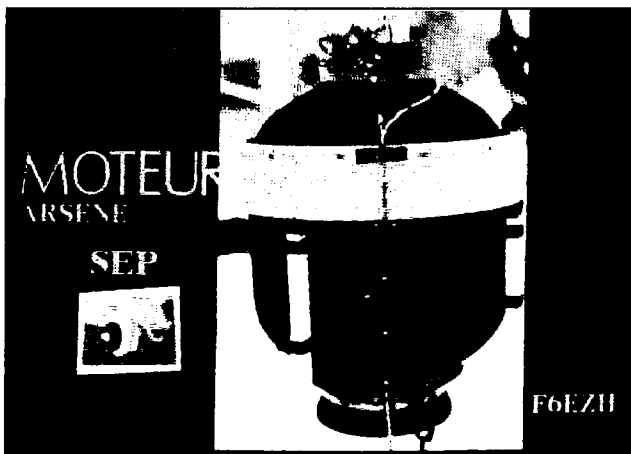


Photo E. View of the ARSENE internal booster for final orbit insertion.

larger TVRO dishes can provide the needed gain when used with a small helix antenna at the dish focal point.

Most of the pictures and figures shown were down loaded from Kitsat-OSCAR-23 at 9600 bps in .GIF image format. Further details on the satellite and its telemetry can be found in the March 1993 "Hamsats" column. AR-

SENE represents a real challenge for satellite enthusiasts. The DX opportunities from its high elliptical orbit are excellent and well worth the effort to configure a station for S-band reception. When Phase 3-D (the next high-orbit satellite) is launched a few years from now, the S-band system promises to be one of the most popular modes.

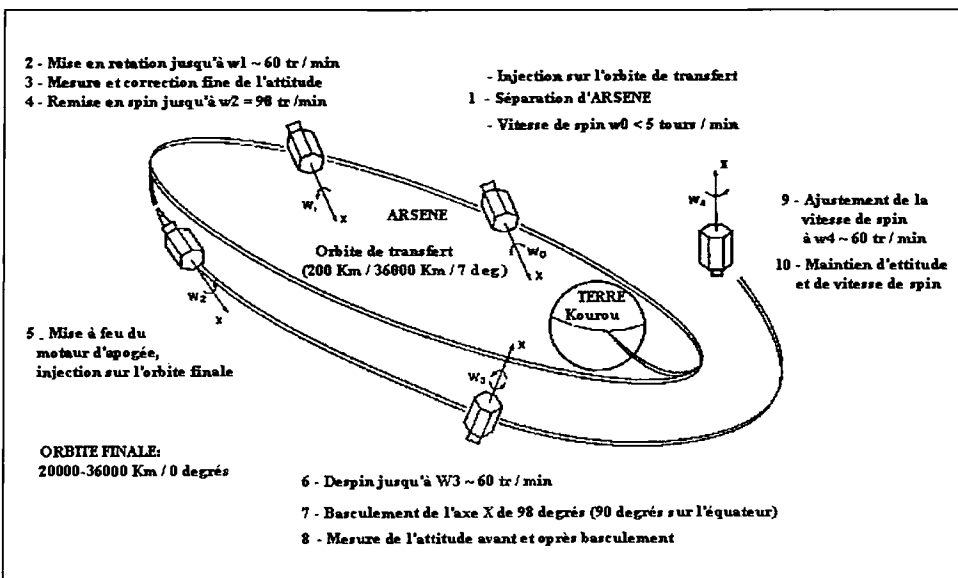


Figure 3. The "Orbite finale," or final orbit, planned for ARSENE is very different from all previous hamsats.

Computer Control for Beam Antennas, Part 1

Give your station a smart, new twist.

by Ron Cole K4OND

If you are an experimenter, you have almost certainly seen bargain TV antenna rotators at hamfests and speculated about using them for ham antennas. You may have hesitated at buying an untested rotator even at five bucks. Hesitate and speculate no more! Those rotators work very well for lightweight VHF/UHF antennas, and can be easily fixed (in most cases). Furthermore, you don't even need to have the indoor control box to make them work. Even if you already own or plan to buy a heavy-duty rotator intended for ham use, most of the principles in this article still apply, and may save you some bucks on repairs when those units fail. This article will also show you how to do automated pointing and/or tracking, including how to control the antenna via a joystick. Although it is aimed primarily at the use of TV antenna rotators and UHF antennas for satellite communications, this article will also teach you a lot about how to take full control of other rotators. In Part I we will look at how typical rotators work, how to control them electrically, and how to read out the azimuth and/or elevation. In Part II we will extend the concepts to computer interfacing, automated pointing, and joystick control.

Rotator Basics

The rotator motor itself is a surprisingly small device, running at about 3600 rpm, and geared down to produce the final antenna speed of about 1 rpm or less. The motor power, supplied through the control cable, is usually about 40 VAC derived from a transformer in the control unit. There are actually three power connections to the motor. One of these is connected to one side of the 40 VAC winding; the other two control the direction of rotation. One of the big mysteries of rotators, direction control, is actually very simple (see Figure 1). A relatively large unpolarized capacitor (C1) is used to produce a phase shift between the other two motor power connections, and it is this phase shift which controls the direction of rotation. Thus, controlling direction only requires a switching of one side of the 40 VAC winding to one side or the other of the phase-shift capacitor. This is done inside the control unit as a part of the direction dial function. By the way, these capacitors are a high-failure-rate item: Almost every "bad rotator" I have found turned out to have a bad phase-shift capacitor. Fortunately, you can easily get a replacement at most appliance repair and electrical supply stores; they are known as "motor-run" capac-

itors. They come in a wide range of values and are rated at voltages well above the 40 VAC used in this application. All you have to do is find an approximate match to the one in your control unit; I have capacitors as much as 50% higher in value than the original one without any problems. Before I learned about motor-run capacitors I tried back-to-back electrolytics and those apparently will not work. While this experience is only based on TV rotators, it almost certainly applies to other rotators as well. It's the first place to look when your rotator won't rotate!

It's not enough to just control the direction of rotation, of course. You also need to get feedback on position (i.e., azimuth), and to stop the rotation when the desired position is reached. In most TV rotator controllers the position feedback is produced by an electromechanical coupling, driven by a solenoid. Refer again to Figure 1. Within the rotator housing, and as a part of the step-down gearing, a rotating cam is used to close the contacts of a switch. The cam is higher up in the gear train and rotates much faster than the antenna. It can produce switch closures for about every five degrees of antenna rotation (depending on the exact model). Each switch closure results in activating a

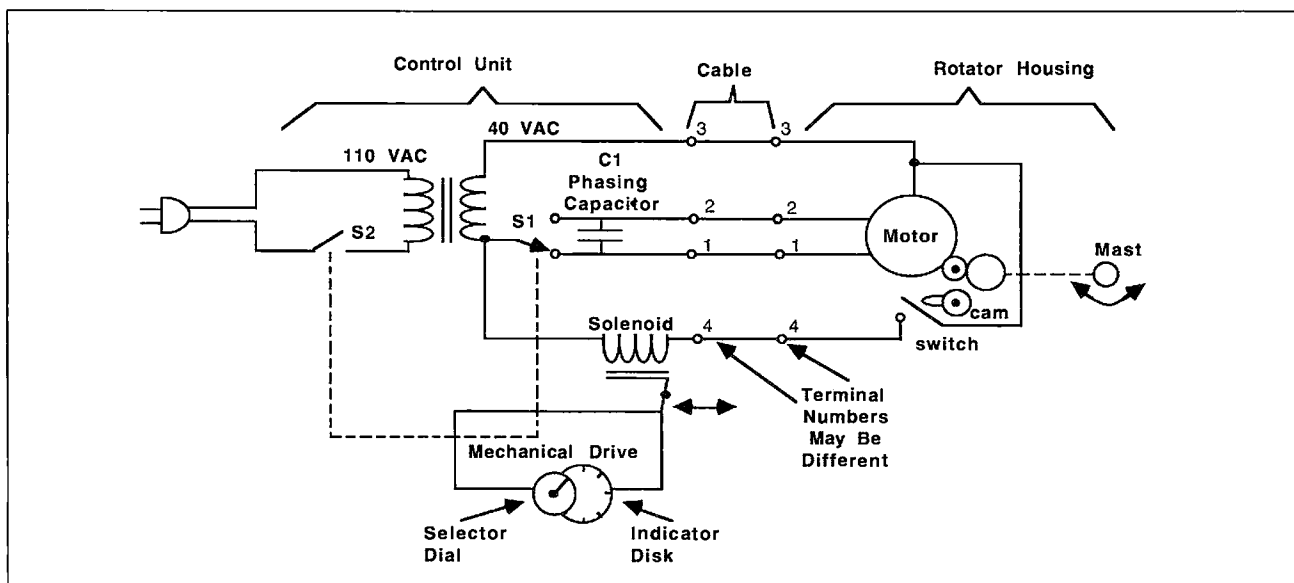


Figure 1. Typical rotator and control box.

solenoid in the control unit, and a mechanism connected to the solenoid turns the position indicator. (It is the firing of that solenoid which produces the typical "clack . . . clack . . ." sound when the rotator is turning.) A very messy set of mechanical and electrical components is used to cause the indication wheel to turn in the right direction, and to stop when the position indicator wheel is aligned with the direction dialed in by the user.

Another, and less common, type of position readout scheme involves using a second motor inside the control unit itself, and running exactly in parallel with the motor in the rotator on the mast. This second motor has a similar step-down gear train, but all it does is drive the position indicator wheel. Again, a mechanical or electrical scheme is used to detect when the two dials match, and stop the rotator. You can easily distinguish between these two types of rotator and control units. The first type (with a switch in the rotator) requires a four-wire control cable (three for the motor, one for the switch); the second type needs only three wires in the control cable.

Both of these types of position indicators are noisy and not easily adapted for any type of position readout other than the mechanical indicator dial. I have also found a few failures in the mechanisms which are virtually impossible to repair. Fortunately, we will soon see how the whole control box can be thrown away (except the 40 VAC power transformer and phase-shift capacitor).

There is one other feature of TV rotators which is important if your intended use is in a satellite antenna elevation system. This feature is the method for attaching the mast to the rotator. For easy adaptation to elevation use, you need to find a rotator which allows the mast to pass completely through the housing (see Photo A). You may have to do some searching to find one of these; they seem to be of older manufacture. All of the new rotators I have seen on the market are built so that the end of the mast rests on the

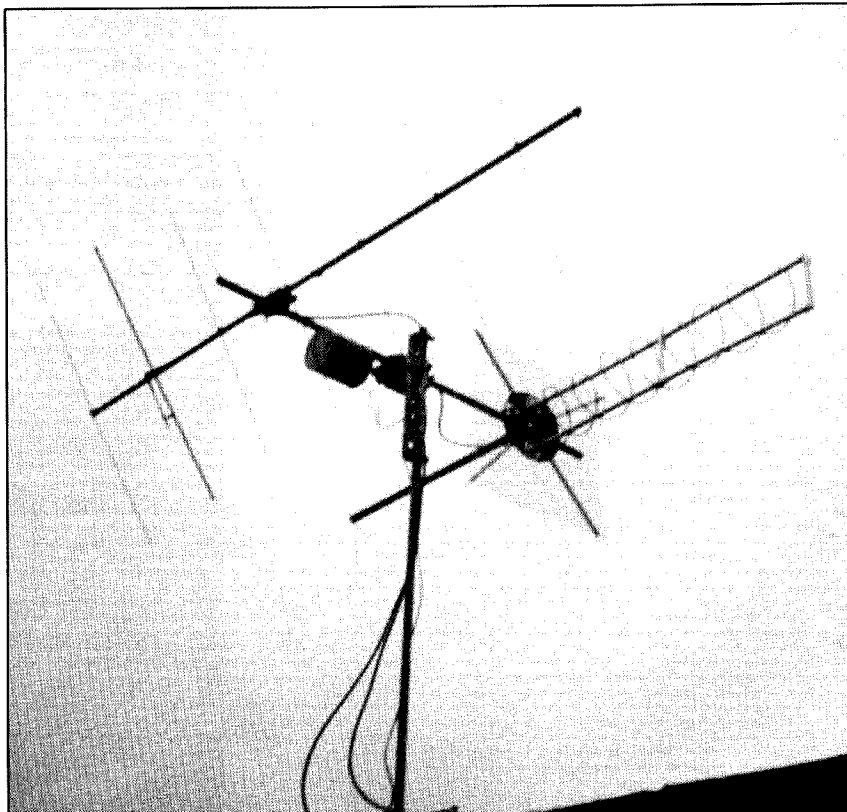


Photo A. K4OND's remote-controlled rotating 2-meter yagi and 70 cm heil antennas.

rotator housing itself, or on a plate which is a molded part of the housing. If the latter type is the only one you can find, it may be possible to carefully cut the plate off and allow the mast to extend beyond the housing in both directions. This approach is necessary since the elevation rotator will normally be mounted at the top of the vertical mast, with a horizontal boom extending out both directions for the antennas themselves. (You may also want to use this type for an azimuth rotator, for the reason discussed below on using potentiometers for position readout.)

Now let's put together a better manual system, and one which is readily adapted to computer control.

A New Control System

It is trivially simple to construct a system to control motor direction and starting/stopping rotation. All it takes is the 40 VAC transformer, a good capacitor, and a center-off toggle switch (a good one is the Radio Shack #275-710, which is spring-loaded for the center-off position). See Figure 2. When you hook up the power wires to the rotator

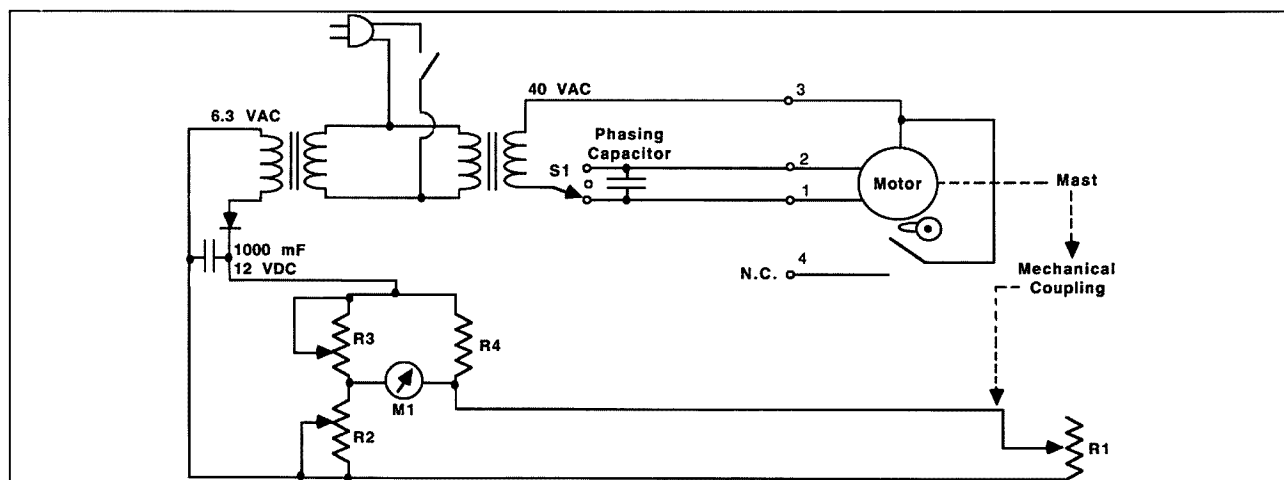


Figure 2. Simple "manual" controller and display. S1 is a center-off toggle. R1 and R2 should be equal, approximately 10k; R3 and R4 should be equal, approximately 5k. M1 should be 0-1 mA, up to 0-10 mA. If a less sensitive meter is used, decrease R1-R4. Adjust R2 and R3 for zero and full scale as R1 varies over its range. Duplicate the circuit if a second rotator is used.

motor, the only one which is critical is the lead which goes directly to one side of the 40 VAC transformer. The other two leads are completely interchangeable. The critical lead is usually marked "3" on the terminal strip on the rotator housing. If all else fails, just try different combinations until you find the right one; the motor will not be damaged by brief periods of wrong connections, it just won't run. The next part gets a lot more involved: how to get feedback on antenna position, and how to display it in an attractive way.

Analog Position Readout Concepts

These "analog" schemes involve mechanically coupling a potentiometer to the mast or boom. With the potentiometer turning in synchronism with the mast (or boom), you can use a meter to read voltage (or current) through the potentiometer, and calibrate the meter in terms of position. We have to find a way to accomplish this mechanical coupling. One of the problems you will find in the case of the azimuth rotator is that ordinary potentiometer shafts don't turn a full 360 degrees like the mast, so you will have to step the rotation down with different sized gears or belt pulleys, or go to a 10-turn potentiometer. I did find a set of gears which could fit into the rotator housing, in place of the cam which normally operates the solenoid-control switch. I brought the shaft out through a hole drilled in the housing and coupled it to a 10-turn potentiometer, but finding these parts was more pure dumb luck than anything else. It is certainly possible to use a rubber drive belt (such as can be found in VCR repair shops) passing around the mast and over a pulley attached to the potentiometer shaft, or maybe even a fairly large "rubber tire" wheel on the potentiometer shaft, mounting it so that the "tire" bears directly on the rotating mast.

A better scheme would be to find a fine-toothed gear which is a little larger than the mast; take the gear and a short section of mast to a machine shop and get them to cut a mast-sized hole through the center of the gear, and braze the gear onto the mast section. Simply insert the short mast section into the rotator, and add more mast sections as needed. Then, mount the potentiometer, with a matching gear, on the fixed portion of the rotator housing so that the gears mesh. Finally, if you can find one of the rotators which allow the mast to pass completely through the rotator, you can put a wooden plug into the very bottom end of the mast, drill a hole slightly less than 1/4" in the center of the plug, and force-fit a shaft into the plug. Then you can couple the pot to the shaft (through a step-down gear, or use a 10-turn pot). Obviously, some mechanical ingenuity is required in any of these methods.

For the elevation rotator, there is a simple scheme which works very well. This scheme involves attaching a potentiometer to the horizontal boom, with the shaft of the pot in line with the boom, then hanging a weight on the potentiometer shaft. As the boom rotates

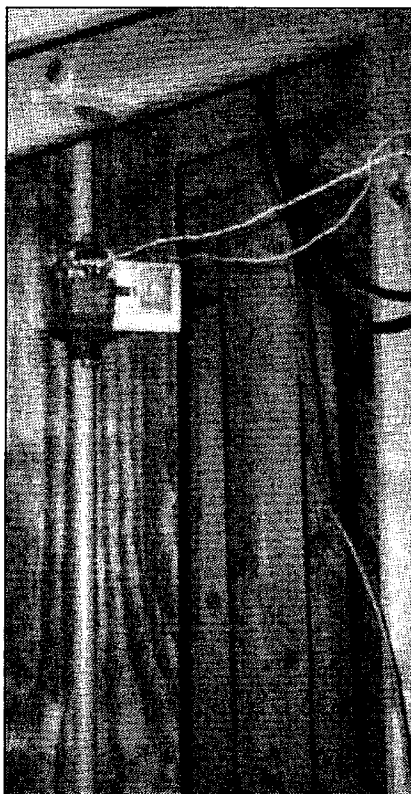


Photo B. The azimuth rotator is mounted between the rafters and the ceiling joists.

up and down, the weight turns the potentiometer shaft, producing the desired change of resistance. Since the elevation will normally be a maximum of 90 degrees (i.e., from horizontal to straight up), we don't even have to worry about exceeding the potentiometer shaft rotation limits. In my elevation system, I simply fastened a large coffee can to the underside of the boom, and mounted the potentiometer and weight inside the can for protection from weather and wind effects. This scheme, while very simple and effective, does have one drawback: As the boom is turning, the weight has a tendency to swing slightly, causing the meter needle to oscillate as well.

As shown in Figure 2, each sensor potentiometer is connected as one arm of a bridge circuit, with the 0-1 mA meter as the position indicator. Typical values for the bridge components are as listed in the figure, but many others will work, and you will probably have to do some "trial and error engineering" anyway to get the meter to deflect full scale as the sensor pot moves. Do this on the bench, before you mount the pots on the rotators!

Although it is possible to use other devices including rotary switches, or even to electronically count the closures of the solenoid control switch, using potentiometers for position sensors has a real advantage if you intend to go all the way to a computer-controlled system: You can read the potentiometers through "joystick" ports, and use software to convert the reading to an antenna

position. (We will explore the concept in Part II of this article.)

Mechanical Assembly

Although this article is mostly about controlling rotators, a few words about rotator mounting may be of help when you build your system. If you used an azimuth rotator which allows the rotating mast to pass completely through the rotator housing, you can save some strain on the rotator by mounting it near the bottom of the mast and placing a bearing of some type under the mast bottom. In one such installation, I poured a small block of concrete in the ground, and stuck a three-foot section of mast near the center. The fixed portion of the rotator mounts on that short section. The rotating mast passes through the rotator, with the base of the mast resting on a ball-bearing mount salvaged from a heavy-duty caster assembly with the wheel removed. The bearing "bears" most of the weight of the mast. The concrete block is about a foot away from the wall of the shack; just below the eaves of the shack a support arm extends from the wall, fitting around the rotating mast just tight enough to provide support without clamping the rotation.

Another method, which worked very well, was to cut a hole in the roof of the shack for the mast (and using a rubber vent-pipe boot to prevent leaks). The azimuth rotator mounts on a vertical board between the rafters and the ceiling joists, and the mast rests on a bearing on a platform on top of the joists. (See Photo B.) The rotating mast protrudes through the roof only about six feet, but absolute height is not that significant when the satellites are more than a few degrees above the horizon. In both cases, the elevation rotator is mounted on an aluminum plate (an old rack panel) mounted to the vertical mast with U-bolts. Holes are drilled in the plate to accept the bolts on the elevation rotator which originally clamped the rotator to a vertical mast. You may be able to make out enough details in Photo A to see this scheme, as well as the 2 meter yagi and 70cm helix in my system, and the coffee can which holds the elevation potentiometer and weight. The two antennas are placed so as to balance the weight on the boom, including the counterweight protruding from the rear of the helix. Close attention to balance will go a long way towards preserving the life expectancy of the rotators.

That's it for Part I. We have seen how to control rotators, how to fix the most common problems with non-working rotators, how to get rid of the electromechanical control unit, and how to get electrical position readouts which are much easier to see than the dial on the original control unit. Is it worth the trouble? Maybe not if you only want to have manual control of your antenna position, but if you want to do computerized control and automatic positioning/tracking, the conversions described above are essential. In Part II we will expand the system to one which provides both manual and computer control, and even allows for the use of a joystick as the control device.

PACKET & COMPUTERS

Number 14 on your Feedback card

Jeffrey Sloman N1EWO
75 Herriott Street
Franklin IN 46131

More Internet Options

I think columns on Internet connectivity get more response than any other subject. I have had many requests for some TCP/IP info—these haven't been ignored. I am working up to a TCP/IP series, so stand by. In the meantime, here's some information for you Internet junkies out there that I think you will find fascinating.

What is the Internet, Anyway?

For the uninitiated among you, here's the scoop. The Internet—note the big "I"—is an enormous network of computers of every description. These computers are located in educational institutions, military installations, commercial enterprises, even hamshacks. These machines—in one way or another—are all connected together using TCP/IP (Transport Control Protocol/Internet Protocol).

TCP/IP—often just called "IP"—was developed by DARPA, a Defense Department wing—to make the Internet possible. The idea of the Internet is something similar to the Interstate system. The federal government built the Interstate system citing national security issues. How could Washington be expected to defend California without a road to get there? While the need for the Internet was not quite as clear-cut, some way was needed for the educational, military, and research organizations who worked together on defense department projects to share data.

Today, the infrastructure of the Internet is maintained by private, regional companies who sell connections and maintain the complicated "routers" needed to insure that your messages get to their destinations.

How About Ham Radio?

Hams get involved in at least a couple of ways. First, quite possibly the most common implementation of TCP/IP protocol for the PC was written by a ham—Phil Kams—and bears his call as a name, KA9Q. The Internet uses Ethernet—a networking scheme developed by Xerox at PARC (their Palo Alto Research Center). Ethernet connections require special hardware, a board called an NIC (Network Interface Card). Each card has its own special "driver" software that understands its hardware and allows oth-

er software to communicate through it. With KA9Q, these drivers are called "Packet Drivers" (no direct relationship to packet radio) and are available in the public domain—making them very popular.

Because these drivers are interchangeable—new hardware, just get a new driver—it is possible to create one for use with an amateur TNC (Terminal Node Controller) running in KISS (Keep it Simple, Stupid) mode. This means that the KA9Q software can be used to run TCP/IP protocol over the air using nearly any modern TNC. This is the heart of TCP/IP amateur operation.

cessible only to licensed hams. To do this, they came up with the idea of "encapsulation." This bit of Internet magic is a little hard to understand. The basic idea is to wrap a TCP/IP frame (data packet) inside another one—encapsulating it. This successfully hides the true origin and destination of the frame, and makes it possible to control which ones will get through to the radios. The term "wormhole" was adopted for this technique, which is very successfully used today.

Wormholes now connect hams in places like Australia, Hawaii, California, Indiana, and even countries in Europe. Practically speaking, this means that I can take a look at a BBS in Melbourne, Australia, from my home in southern Indiana, using a 5 watt handheld. Fun, fun, fun!

Getting Involved

As I said in the introduction, I

***"For the uninitiated among you,
here's the scoop. The
Internet—note the big 'I'—
is an enormous network of
computers of every description."***

Ham stations running TCP/IP offer some interesting possibilities. One really big one, not lost for a moment on the hams involved, is the use of the Internet to send data anywhere—or nearly anywhere.

The only problem these hams had—other than malfunctioning keyboards, brought on by the drooling anticipation of actually making this connection—was to insure that FCC regulations were not violated. They had to be sure that access to radio transmitters located at the end of these Internet links were ac-

cessible only to licensed hams. To do this, they came up with the idea of "encapsulation." This bit of Internet magic is a little hard to understand. The basic idea is to wrap a TCP/IP frame (data packet) inside another one—encapsulating it. This successfully hides the true origin and destination of the frame, and makes it possible to control which ones will get through to the radios. The term "wormhole" was adopted for this technique, which is very successfully used today.

First, from the radio side. Thanks to the growing popularity of IP as a way of networking PBBSs (Packet Bulletin Boards Systems), the idea of AX ↔ IP gateways is catching on. With these systems, the packet user connects to the PBBS using ordinary AX.25 (packet) protocol, and the PBBS provides access to the Internet functions through a

menu. This is lots of fun.

The WG7J PBBS software seems to be the most popular, so I'll discuss it. First of all, the PBBS will allow the exchange of packet messages just like any PBBS. There is a difference in presentation, though. With a WG7J system, messages are collected into areas, and the area command (abbreviated "a") allows the user to switch among them. The areas are based on topics, like SALE, BARTER, WX, etc. There is also an area created for each user—any messages to you will appear in an area named with your call. This is a much more convenient system to use than the more familiar WØRLI type listing.

Many of the other commands will be familiar or self-explanatory. I will ignore those and concentrate on two Internet options, "finger" and "telnet."

Finger

The Internet utility finger is used to query a remote system for information. It has two basic purposes in the Internet world, one is to get information about users and systems—the other to get specific text files offered by systems for the convenience of users.

The first use allows a user to determine if a particular person is a user of, or is known by, a machine. The syntax is simple:

finger N1EWO
would tell you whatever the system you are currently using knows about me.

finger N1EWO@K9IU.AMPR.ORG

would tell you what the PBBS run by the folks at Indiana University in Bloomington knows about me.

The other use is also simple. What you can do with it depends on what the sysop at the system you are fingering wants to offer. For example:

finger weather@iugate
will return the NWS forecast for central Indiana. This is one of the ways in which Internet resources are available.

Telnet

The telnet utility is very powerful, if very simple. Basically, it allows you to connect, as a user, to any system willing to have you. For example:

telnet n8imo.ampr.org
will connect me to N8IMO's WG7J PBBS in Michigan. When you telnet you will generally be logging into a UNIX system (or something acting like a UNIX system). You will be presented with a prompt:

login:
Use your callsign, then when prompted for a password, try "amateur" (omit the quotes). There are two things to keep in mind. First, UNIX logins accept just about every

?A,B,C,D,E,F,H,I,J,IP,J,K,L,M,N,NR,O,P,R,S,T,U,V,W,X,Z # h					
Usage					
H[elp] [<command-name>]					
Description					
The help command will display help for a given command. The help command by itself, displays this particular message. To get help for a specific command, enter "help" followed by a space and then the name of the command you want described. The following commands have help descriptions available for them:					
area	bye	connect	download	escape	finger
help	info	jheard	kill	list	musers
nodes	operator	ports	read	send	telnet
upload	verbose	xpert	what	zap	
Examples					
help area (displays a description of the "area" command)					
h download (displays info about downloading files)					

Figure 1. "The help command output for a WG7J system. Note the unusual commands like "finger" and "telnet" used for Internet connections—see the text for more."

character your keyboard can generate as part of the user name and password. If you mistype, a backspace may not clear up the problem. The second thing is that UNIX is case sensitive—that is, it cares about the shift key. Type the call and password in all lowercase. If you do not, the system may not let you in, or it may decide that you want everything in UPPER CASE FOR THE REST OF YOUR SESSION. This can be very annoying.

Other resources available via telnet are various sorts of "servers." These machines offer information of all sorts which can be very useful. For example:

telnet 141.212.196.79 3000

will connect you to the University of Michigan's "Weather Underground." This is a weather server that provides nearly every text product produced by the National Weather Service, including forecasts and severe weather bulletins. This is a marvelous resource for you "Sky Warn" participants out there.

Coming in the Other Way

I told you I'd have some exciting news for Internet junkies! Those of you with landline Internet access can get involved from the other direction. If you have access to Inter-

net telnet, try:

telnet K9IU.UCS.INDIANA.EDU

Login with your callsign and the word "amateur" for a password. The first time you log in, you won't be able to do much except leave a message to the sysop (s sysop). Leave a message requesting access, along with the password that you want to use. In a few days, you'll have an account—and "amateur" will no longer work as a password. Once you have access you will be able to telnet onto the amateur IP network and have lots of fun.

There is a lot more to the Internet and ham radio than what you have read here. I hope you choose to explore it. Keep your eye on this column for more information.

A Request of Sysops

If you are a sysop of an AX <—> IP gateway, I would love to hear from you so I can let people know that you exist. Send mail to:

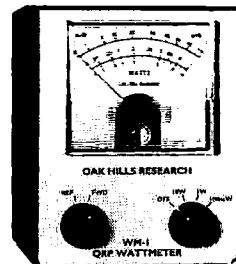
jsloman@bix.com

with your PBBS info, including your frequency and intended coverage area.

73 de N1EWO.

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CIRCLE 82 ON READER SERVICE CARD

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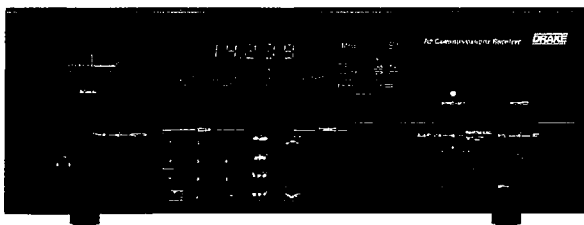
They appreciated the R8's sensitivity, clarity, simplicity, and all-around versatility so much that many of them declared the R8 simply the best of its class. High praise, indeed, from very well-traveled ears.

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Bill Clarke

73 Amateur Radio Today



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Receiver within 15 days, and we'll refund your money in full, less our original shipping charge. To order your R8 factory direct, for more information, or for the dealer nearest you, call **1-800-723-4639** today. We're confident that once you've listened to the R8, your ears will hear of nothing else.



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CIRCLE 147 ON READER SERVICE CARD

73 Amateur Radio Today • August, 1993 59

Number 15 on your Feedback card

chance of rendering the chassis of your teleprinter hot, creating a potentially lethal situation.

A line isolation transformer simply isolates you from that situation, without changing the voltage. Connecting the secondaries of two filament transformers to each other, as shown in Figure 2, accomplishes just that goal, at minimal cost.

As for the loop supply itself, it can be as simple or complex as you would like it. Figure 3 is my favorite basic supply. Just a transformer, a diode, and a capacitor are all you need to get basic direct current. The current limiting resistor is needed because of the low resistance of the selector magnets. In the typical Model 15 teleprinter, there are two selector magnets, each with a resistance of 105 ohms. Accessible on terminals 45 and 46 on the side of the machine, they may be connected in either series or parallel. A series circuit, with a total resistance of 210 ohms, is designed for operation at 20 mA, and a parallel circuit, with a combined resistance of about 52 ohms (according to Bob's memory), is for the more common 60 mA loop. Now, if the loop supply delivers 150 volts, and the resistance of the magnets is about 52 ohms, the resultant current would be (remember Ohm's law?) $150/52$, about 3 amps! "Burn out those magnets real quick, don't 'cha think?" Therefore, a series resistor is included to limit the current to

the proper 60 mA current. Normally, this is about 2000 to 2500 ohms. It is important to make this a high powered resistor, though, as, for example, with our 150 volts at 60 mA, the wattage will be 150×0.06 , about 9 watts.

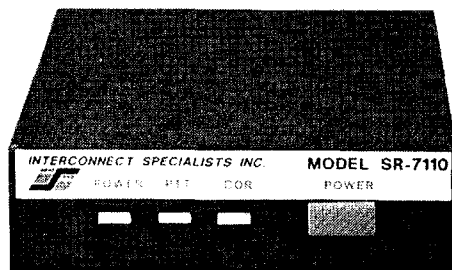
So there you have it, a simple driver for older machines to let you run a teleprinter off a low level signal. Hope this is useful to you, and I look forward to receiving other thoughts on this ever-changing subject.

Collect the Whole Set!

Speaking of changing, the latest disk of software is filling up, with more RTTY goodies. Any of the four of the collection can be yours. Just send either a 5.25" or 3.5" disk, \$2 per disk to be filled, and a note telling me which collection you want, along with a self-addressed, stamped disk mailer, and I'll get it back to you right away. Collections #1, #2, and #4 are RTTY/packet programs; collection #3 is a bunch of archiving and viewing utilities. Just send me a self-addressed stamped envelope if you want a list of what's in each archive collection, if you want to peek first.

I look forward to more mail and comments this month. The summer is here and we can all feel energetic. Drop me a note at the above address, or Email via CompuServe (ppn 75036,2501), Delphi (username MarcWA3AJR) or America Online (screen name MarcWA3AJR). 73

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2 meters 220 440

CIRCLE 144 ON READER SERVICE CARD
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Radio Direction Finding

Joe Moell P.E. KØOV
P.O. Box 2508
Fullerton CA 92633

For T-Hunters Only . . . Not!

As you leaf through ham magazines, you won't find ads for lots of products designed specifically for transmitter hunters. Nevertheless, radio direction finding (RDF) enthusiasts can find many items that are useful on "foxhunts" or "T-hunts", as RDF contests are called.

Often, the sellers of these products don't mention their foxhunting applications. I suspect that's because they are unaware of them! This month, we will look at three offerings that are aimed at the mainstream ham radio market, but are of special interest to T-hunters.

World's Lightest Yagi?

Hiking and emergency preparedness, as well as RDF, were on the minds of Mike Walker KAØVFF and Al Lowe NØIMW when they developed the Arrow Antenna (Photo A). This 4-element 2 meter yagi is rugged, yet very lightweight. It can be assembled and disassembled quickly. Elements fit into the aluminum boom or the supplied PVC pipe carrier for storage and transport.

T-hunters quickly recognized this beam's suitability for mobile RDF. They have been talking it up since construction plans were published in the April 1992 issue of *73 Amateur Radio Today*. For example, I recently communicated with hams in Montreal and Memphis who use arrow designs on their local hunts. Many RDFers have duplicated the

antenna from the magazine article, while others have purchased theirs ready-made from the Arrow Antenna company.

KAØVFF has stepped aside, leaving NØIMW as the sole proprietor of Arrow Antenna. Al and his family are churning out yagis and doing a brisk business at hamfests and via mail order. "I've been selling a lot of them to hams on the front range here in Colorado," he says. "Search and rescue is using them, and so are some balloon trackers."

Al and Mike cleverly picked lightweight aluminum arrow shafts for their beam elements. At about 1-1/4 pounds, the Arrow Antenna is much easier to turn at low vehicle speeds than my PVC-pipe stiff-wire T-hunt quad. I was surprised when I compared Arrow shafts to the usual hollow aluminum antenna tubing. An Arrow element of the same outside diameter and length weighs only half as much as a tubing element!

Masts and associated hardware are not supplied by Arrow Antenna. Al says a metal mast does not impair the beam pattern, but I used thick-walled PVC pipe for my mobile tests. I mounted a U-bolt permanently to the mast and drilled two pairs of holes in the boom at the center of gravity. This allowed me to change the yagi quickly between horizontal and vertical polarization without affecting my mast pointer alignment. Some T-hunters have designed 90-degree hinges for instant polarization change.

In my RDF tests, the Arrow Antenna had slightly higher gain than my regular 4-element quad. Its

front-to-side and front-to-back pattern was excellent. Good SWR was obtainable across the entire 2 meter band.

For close-in hunting on foot, Al suggests reconfiguring the antenna by removing the front director and swapping positions of the other director and reflector on the boom. This gives you a 3-element beam with a 15-inch mast handle in the rear for easy carrying.

Despite its light weight, this yagi withstands the rigors of mobile foxhunting well. Parts and workmanship of NØIMW's antennas are guaranteed for one year. Al says, "In my T-hunting experience with tree limbs and street signs, the only damage has been to bend the 8-32 studs that attach the elements. These can be easily straightened or replaced to finish the hunt." Replacement threaded rod is readily available around the country.

RF by the Numbers

A field strength meter (FSM) is a simple untuned receiver that visually indicates the relative strength of the surrounding RF field. Hams most frequently use FSMs to compare the gain and directivity of antennas, and to tune/adjust antenna matching networks.

T-hunters use FSMs for close-in RDF when the fox's signal overpowers sensitive portable receivers such as handie-talkies and scanners. Probing on foot with a FSM is called "sniffing."

Inexpensive unamplified FSMs require 50,000 microvolts or more of RF input for usable indications, making them unsuitable for sniffing except when the transmitter is inches away. Amplified sniffers have more sensitivity, but some have limited meter range or touchy zeroing adjustments.

I.C. Engineering has just introduced a DC-to-microwave FSM with

digital readout. The "I.C." in the company name isn't short for "integrated circuits." It stands for Ismael Charnabroda KD6TU, the company's owner. Ismael, a former aerospace engineer turned entrepreneur, is enthusiastic about his product.

The Digi-Field (Photo B) is a rugged plastic box 4-3/8" x 3-1/4" x 1-3/4" with an SO-239 antenna connector on top. An 18-1/4" telescoping whip antenna is also supplied.

The 1/2" high 3-1/2 digit liquid crystal display is ideal for antenna pattern checks. Set the unit on a fence or ladder several wavelengths away from the transmitting antenna under test and watch the readings on this FSM with binoculars as you tune and tweak the antenna or transmitter.

Battery life won't be a problem with the Digi-Field. It draws only 2 milliamperes, so its 9V alkaline battery will last hundreds of hours. An indicator tells you when the battery drops to 8V, but in my tests the accuracy was not affected until the voltage got down to below 4V.

With only one control (the on-off switch), operation of the Digi-Field is straightforward. KD6TU doesn't provide a detailed instruction manual, but he offers technical assistance by phone to buyers.

The original Digi-Field ("A" model) and its telescoping antenna will detect a 1-watt 2 meter handheld with "duckie" antenna at 65 feet. Overrange occurs at about two feet from the HT. The new "B" model is more sensitive, overranging at 25 feet.

Because the Digi-Field has an unshielded case, body capacitance affects readings. To avoid this, mount the unit to your sniffing antenna mast instead of holding it in your hands. Avoid touching the coax connector when sniffing, as the reading will be affected.

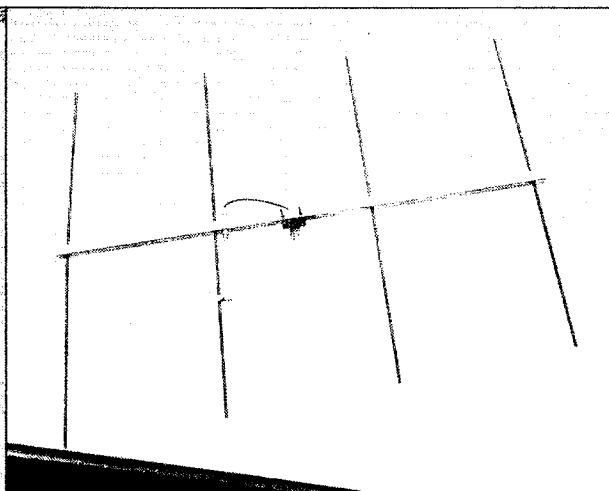
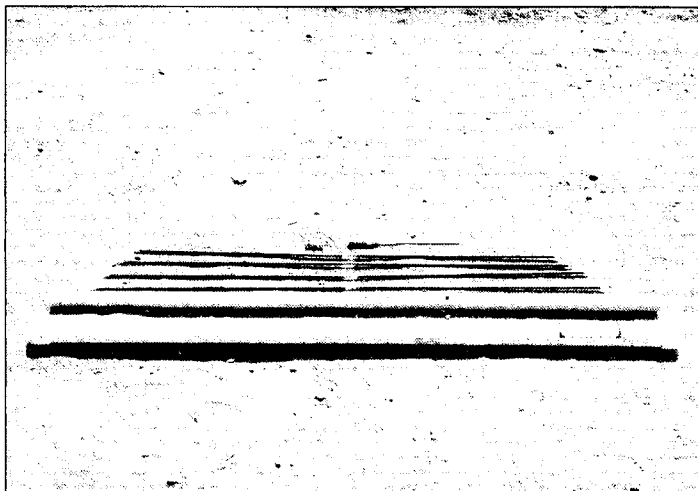


Photo A. The Arrow 2 Meter Yagi Model 144-4 has a suggested retail price of \$89.00 and is available from Arrow Antenna, 1461 Peacock Pl., Loveland CO 80537; (303) 663-5485. The latest model features caps on element ends for safety, instead of the sharp points shown here.

No sensitivity control is provided. You can shorten the antenna or add external attenuation to reduce the meter reading. However, the Digi-Field's internal wiring can pick up RF, so close-up measurements of powerful T's may not be possible, even with the whip antenna collapsed or removed. With the antenna disconnected, the 1 watt rig overranged the B model at 6 inches.

Digi-Field responds to RF from low frequencies well into the microwave spectrum. Full sensitivity is available to 1000 MHz, and reduced sensitivity continues to 12 GHz. While this is generally useful, it means that strong ambient RF fields can mask the signal you're looking for. You don't have to be at

a communications site to have high RF fields. When I held the B model over my head in the center of a large suburban park in Fullerton, California, the indication went to half scale, even though I was blocks away from the nearest transmitting antenna.

The detector output jack on the side of the Digi-Field can be hooked to an audio amplifier and speaker or phones to give you an idea of what is being received. Only amplitude modulation can be detected in this way; you cannot copy FM signals. The jack will not drive an earphone directly, and the wiring to your amplifier can cause additional unwanted signal pickup.

As with all FSMs, Digi-Field measurements are relative, not absolute. The digital readings are not in dBm, milliwatts, microvolts, or any other units. KD6TU will provide typical power-versus-readout graphs on request. You can perform your own crude calibrations with a laboratory signal generator, but your indications will vary with frequency, temperature, and source impedance. For foxhunt sniffing, all we care about is relative strength, so this is of little concern.

Lilliputian ID-8

Engineers at Communications Specialists weren't thinking of the RDF market when they designed the ID-8, a miniature CW identifier. But Mike Wolfe N9CHQ, who purchased one of the first units, was quick to see its T-hunt possibilities. He wrote to me on CompuServe that an ID-8 is the brains of a fox transmitter he built to put on hunts for the North Shore Radio Club in Highland Park, Illinois.

The ID-8 is a tiny circuit board (1-7/8" x 1-1/8") with a surface-mounted 6805 microprocessor, EEPROM, and voltage regulator. Hook it to a transmitter and it will generate CW identification at programmed intervals, either by keying the carrier or by providing a keyed sine wave tone to the modulator.

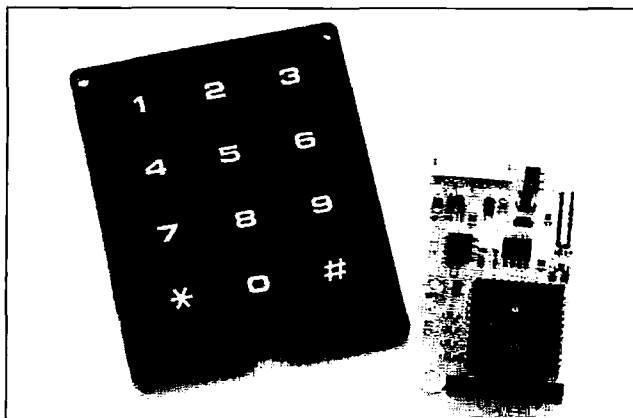


Photo C. The ID-8 identifier board and keypad has a suggested retail price of \$89.95 and is available from Communications Specialists, Inc., 426 Taft Ave., Orange CA 92665; (800) 854-0547; (714) 998-3021.

The ID-8 can send up to eight separate CW messages. The eight messages can be played successively to form one long message of up to 216 characters. Messages are entered with a supplied 12-button keypad (Photo C), which is plugged into the ID-8. With this keypad, you also instruct the ID-8 how fast to send the CW (1 to 99 WPM) and how often to send the message (continuously, by external command, or spaced up to the 10-minute FCC limit).

There are several other programmable parameters including tone frequency and dead-carrier delay time before the message. When programming is completed, parameter and message data is stored in the EEPROM. You can then remove the keypad until you need to change call sign or timing for another hunt.

The ID-8 needs only 6 milliamperes from a 6 to 20 volt DC source. A 9V transistor radio battery will power it for days. Comm-Spec says it's immune to thermal variations and RF fields. The operating temperature range is -30 to +65 degrees Celsius.

N9CHQ was quite pleased with the ID-8 as a fox controller. Though

it lacks the distinctive tone patterns of the foxboxes discussed previously in this column, it was just right for his club's on-foot beginners hunts. "What I like about the unit is that I can program the ID and timing in the field," he wrote. "Normally I use 25% duty cycle, 15 seconds on, 45 seconds off. I program in the ID and then adjust the code speed so that it lasts for 15 seconds including a short delay on keyup. I then set the off time."

"Once it is programmed," he adds, "I connect a 3-conductor cable to the transmitting HT. I turn on the unit and it runs by itself. The unit's timer appears to be very stable. During the hunts in which we have used it I have not noticed any drifting in the timing circuit. It really works beautifully, and does not need any shielding."

From my standpoint, the main appeal of the ID-8 is its size. An ID-8 and keyer this small seems perfect to go with the subminiature VHF transmitter described in the May 1993 "Homing In." KB6TTS and I are designing an FM modulator and interface to connect these two boards. With luck, we will have tested circuits for you next month.

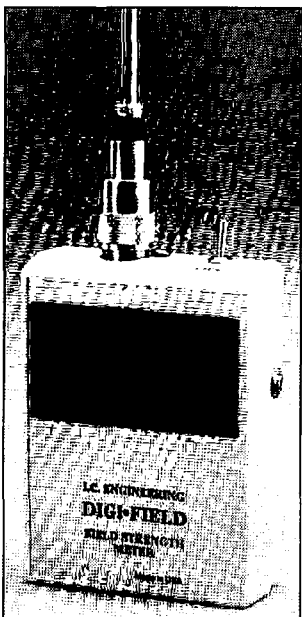


Photo B. The Digi-Field Model A and B Field Strength Meters have a suggested retail price of \$119.95 and are available from I.C. Engineering, 16350 Ventura Blvd., Suite 125, Encino CA 91436; (818) 345-1692 (Tech. Info.), (800) 343-5358 (Orders).

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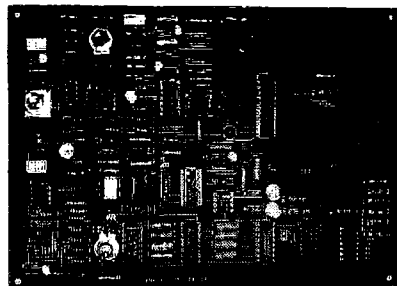
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Dayton '93 Youth Forum

It's always an auspicious occasion when grown-ups get together to honor the achievements of children. Certainly, the young adults who showcased their achievements at the '93 Dayton Hamvention Youth Forum deserved the spotlight. It was an honor to moderate a forum with such talented children from across the country.

Our first speaker was Rusty Smith KD4GLC, who is 17 years old and is an Assistant Section Manager in Kentucky for the ARRL. His main responsibility is to recruit young people into ham radio. Rusty is interested in DX-ing and contesting. He told us that his goal was to lead the state of Kentucky in the Novice Roundup using CW only. He succeeded, and said that this event was the most fun he has had so far as a ham radio operator.

Barry Kennedy N2PNG is 16 years old and comes from New Hampshire, where he attends the Dublin School. Barry is active in recruiting young people and has done some teaching at Crothched Mountain School. This is a rehabilitation facility that has had some extraordinary results with their young people through the use of amateur radio classes.

I would never run a youth forum without at least one member of the distaff side. Shauna Richards N7NGT is a bright, pretty 17-year-old young lady from Rock Springs, Wyoming. Shauna was the first teenage girl in Wyoming to earn a ham license. That was on 8/8/88. In 1990 she earned 1st and 3rd place at the district and state science fairs as a freshman in the senior engineering division. Her winning science project was on five modified 2 meter antennas that would function well even if trapped under a collapsed double-decker highway, such as the

one which fell in the 1989 San Francisco earthquake. Then, in 1991, she received the Hiram Percy Maxum Memorial Award.

Matthew d'Alessio KC6VIM is 15 years old and lives in San Anselmo, California. He captivated the audience with his eloquence and confident manner in front of such a large group. Matt spoke about how much he enjoys CW. He also enjoys working 2 meter FM with his hand-held radio. Matt says, "There is nothing like working the world on a few dots and dashes on a cold winter night. I have talked with hams in 60 countries using these 'crazy beeps.' Matthew got a terrific reaction from the young people in the audience.

Eric Permut KB0KQF is a 12-year-old from Boulder, Colorado. I first heard about Eric from Rip and Ellie Van Winkle, who run license classes in Boulder. The Boulder Amateur Radio Club sponsors "BARC Jr." for young people. Eric is vice president of that club. He also handles net control for the junior hams' net on a local 2 meter repeater. Eric successfully wrote a grant application for his school to buy ham radio equipment. The young man regularly operates bicycle mobile and has constructed an innovative J-pole antenna for his bike. He brought the antenna to the youth forum to show everyone, along with a display of photos of the BARC Jr. club members.

Mike Placco KB8LCC is a 16-year-old from Milford, Michigan. Mike was a shortwave listener first before he became a ham. He has held the position of secretary of the Milford Amateur Radio Club. Mike enjoys HF, CW, and contesting. He enjoys helping his teacher with the radio club at the local high school. I was pleased to learn that many of these young amateurs contribute to recruiting and helping programs too.

Ten-year-old Luke Ward K04IQ is from Alexandria, Virginia. The audi-

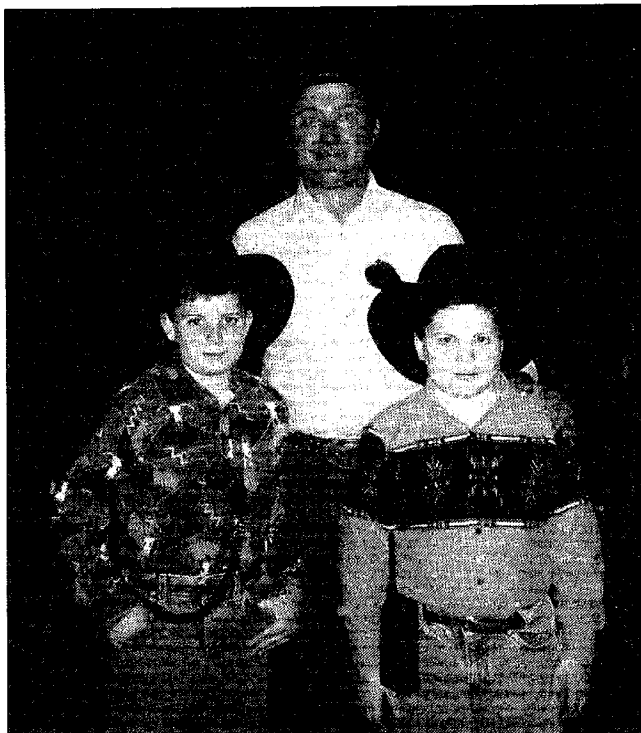


Photo A. When these three visit a hamfest, it looks more like a round-up at the OK Corral! Pictured are Cody KB5WYJ, Casey KB5UE, and dad Marty Haley AB5GU at the Dayton Youth Forum.

ence members were visibly excited when they learned that Luke has earned his Advanced license. In fact, Luke holds Novice classes for third graders. He gave a "professional" presentation with the overhead projector, showing graphs that gave statistics about children of hams becoming licensed. He helped found the Springfield Estates Elementary School Amateur Radio Club which has as one of its purposes: To provide a vehicle whereby parents, students, and teachers can share common interests and work toward common goals.

Casey Haley KB5UE and his brother Cody KB5WYJ are 8 and 10 years old respectively (see photo). Casey has a General license and Cody a Tech Plus. These two youngsters from Houston, Texas captivated the audi-

ence with their ability to communicate what they love about amateur radio. They both were introduced to the hobby by their Dad, Marty AB5GU, and Mom, Wende KB5TNU. The boys enjoy packet and CW. I've invited the Haleys to join me in June at the Texas HamCom in Arlington.

It's always a personal pleasure for me to work with youngsters from all across the country at various youth forums. This time, I was especially honored to meet and help feature such talented and eloquent young adults. I invite everyone to attend the youth forum in Texas. Come and see the best that our hobby has to offer. Come and see the future of amateur radio! By the way, Yaesu has donated a 2 meter HT to be given to a very lucky youngster at the forum. See you there!

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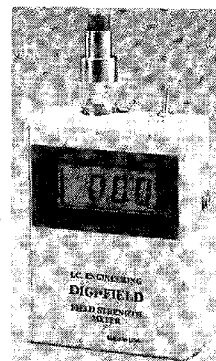
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Fixing an Argonaut 509 (Continued)

Now that I've made a complete fool of myself with the Argonaut, it's time to get down and get serious! It's also time to break out the test gear and the soldering iron, along with the manual.

Since we have verified that the Argonaut is producing 2 watts RF output, the next step is to be sure the transmitter is producing power on all bands. A quick check with the wattmeter proved all bands were producing RF. Since the problem had to be in the metering circuit, that's where I started to look.

The Metering Circuit

The metering circuit is contained on one PC board mounted to a switch shaft. You must remove the PA module to get to the SWR board. This board is not removable by unplugging it from a socket. There are many wires coming out of the board, and each is soldered in place. There is enough slack in the wires to allow the board to be moved

from its cubbyhole out into the open. To do this, remove the two nuts from the switch shaft holding the board to the switch. Be careful—they are very small and are easy to drop inside the radio.

After you have the two nuts removed, notice there are several washers and spacers on the studs. Carefully remove these and lay them aside. Now, pull the PC board back out from the shaft. After the PC board has cleared the shaft, you can pull it up slightly. If you can't move the board, don't pull it or force it to move. Doing so will break off a wire.

Since there is no indication of forward RF, then the most likely suspect would be a diode in the RF pickup sensor. In fact, the diode must be the one used to read forward power. The schematic shows this to be diode D1. It's a 1N32A type germanium diode.

Not being one to check diodes, I simply replaced it with a new diode. Don't use a 1N914 silicon diode! You'll not get the desired results if you do. You must use a *germanium* diode. If you can't find a 1N32A, then try a 1N60. Radio Shack sells a pack of 1N32A diodes for about two bucks.

After the new diode had been installed, I installed the PC board back inside the rig. You simply reverse the removal procedure. When tightening up the nuts on the switch shaft, don't get too carried away or you'll end up stripping out the threads and then you'll be in real deep dung! Finger-tighten them and then give them one full turn more.

Power up, and with the output of the rig into a dummy load, hit the tune position. Whoa! Works just like downtown! After all that messing around, to find out the problem was just a 10-cent diode takes it toll on the old self-confidence. Oh, well: One down and one (dead Argonaut) to go.

Another Argonaut Bites the Dust

This Argonaut is mine. I cooked it trying to find out what was wrong with the first one. Now, since I know the trouble was only a diode, what did I do to cook the other one? It's apparent the boards must be working correctly, but then again, look what happened the last time I assumed!

Since my Argonaut won't go into transmit, the likely spot to look for trouble would be the control board. The control board tells the other circuit board what to do and when to do it.

The control board is mounted on the top half of the Argonaut and almost directly over the meter and drive controls. It's a plug-in board with several trimmers mounted on it.

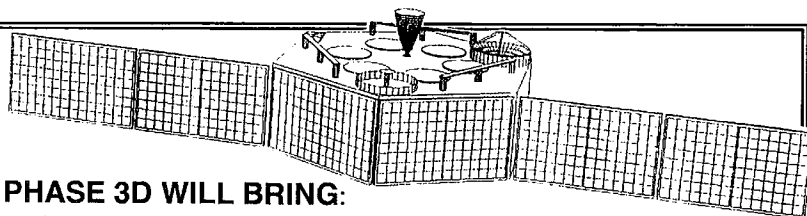
Since the control board does all the T/R switching, voltage checks on the "T" and "R" lines revealed that the "T" line was not going to +12 volts when the Argonaut was keyed. It then became a simple matter to follow the voltages as the key line was closed. After a few minutes of looking and checking, it became obvious the MPSU01 did not turn on and off as it should. Looking closer at the board and the transistor, it became quite clear why—the center lead of the transistor had broken off right at the component's base. You had to hold the board just right to see the broken lead on the transistor's body. It must have broken off while swapping control boards from one rig to the other.

Now, you can't just go down to the local Radio Shack store and get one of these critters, so a call to Ten-Tec provided me with the replacement part. In a few days they came in and within a matter of minutes the Argonaut came back to life.

Touch That Dial

If you have to order parts from Ten-Tec, always include a dial cord kit. You can always use it yourself or give it to someone else who can use one. They're not too hard to install, but it does require a complete strip-down of the Argonaut. If you have to remove the end panels you may as well replace the dial cord while you're at it.

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Photo A: The Ten-Tec Argonaut 509.

when you're not using the rig, move the pointer all the way down to the low end of the dial. This removes nearly all the tension from the elastic cord, extending its life. As you move the pointer closer to the meter, you increase the pull on the elastic, thus weakening it. After awhile, when you move the pointer down to the low end of the band, the pointer will sag down into the window. At this point you'll have to restring the dial with new elastic cord.

If you made it to Dayton this year

and did not get sick from the rain and cold weather, you probably were feeling well enough to pick up a used Argonaut. If you did, and you're still hoping that someday the other guy will send you the manual, you're in luck. You can get a complete manual for just about all the Ten-Tec rigs by calling their service department. You'll get a photocopy of the manual for about \$20. Expensive, yes, but really worth the money when the Argonaut goes down.

A Sneak Preview

Dayton also provided a showcase for Ten-Tec to show off their new "Scout" transceiver. I'll have a full review in a coming "QRP" column, but here are some of the highlights of the Scout.

It's born as a monoband rig. You can change bands by swapping out a front panel plug-in module. The Scout will cover all the ham bands, including the WARC bands. Each band module costs \$25. You get the band of your choice

with the purchase of the rig. The band modules are about as long as a pack of cigarettes and about half as wide. The Scout will operate CW using the famous Ten-Tec QSK system, and of course it will cover SSB, too. Power output is 50 watts. Input power is rated at 100 watts. A QRP version of the Scout will be available down the road. The price will be about \$50 less than the QRO version. You can turn down the power of the QRO version by adjusting the ALC control. Of course, the efficiency goes in the dumper, but you'll be able to operate QRP levels with the 50 watt version if you so desire. Current at full transmit output would be close to 9 amps. This current requirement can easily be met through the lighter plug in your auto. The CPU will demand up to 1 amp sitting there. I'll have a full run-down of the current demands when I get the unit in to do the full review. A small 10 amp power supply will be available as an option for the Scout. The Scout features a very easy-to-read LED display. I don't yet know if you can turn off the display.

QRM fighting controls include the adjustable Jones filter and an RIT control. There is an optional noise blanker to combat impulse-type noise. There is a built-in keyer included, too. A nice-sized combination S-meter and RF output meter round out the features of the Scout. First impression? Looks like a winner!

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The W9TE Crossband ATV Repeater

I've been asked many times about the pitfalls and obstacles that need to be surmounted in order to successfully build an ATV repeater. This month I'd like to offer you the story of how members of the Fort Wayne Radio Club solved both the technical and political problems involved in installing a very effective ATV repeater, as described by Jim Pliett K9OMA. The following is his account.

Finding a Site

I (K9OMA) am an active ATVer with a few years experience operating simplex. I became intrigued with the idea of building an ATV repeater in the Fort Wayne area after seeing the Indianapolis ATV repeater in operation while attending meetings of the Indiana UHF club.

One day, while driving to work, I saw an empty tower at the Indiana/Purdue campus and wondered if there was any possibility of installing our ATV antennas on it. It was located right in the middle of the Fort Wayne amateur radio community and was nearly 170 feet tall.

Now, how does one deal with the politics of a state-funded community college to obtain permission for a repeater site? Lucky for us, one of our club members worked at the college

and helped us gain a favorable position with the college board. Meanwhile, we set out writing letters to the National Weather Service and the Director of Emergency Preparedness describing how an ATV repeater could aid the community in the event of a disaster or emergency. We obtained letters of support from these organizations and presented them to the college board. After a few months of anxious waiting we not only obtained permission to use the tower but they provided us with an equipment room to boot!

We presented the idea of the ATV repeater to the members of the Fort Wayne Radio Club. We weren't sure we could sell the concept to a club that already supported two VHF repeaters and one UHF repeater, as well as sponsoring a large Field Day effort. However, since the club was recently solvent thanks to their last two successful hamfests (and probably thanks also to a few members who just wanted to end the meeting), the motion to fund the project was passed. Our first ATV repeater was getting closer to a reality!

Building the Repeater

Fortunately for us, Bruce WB8UGV had moved to the area from Dayton, Ohio. Bruce had a lot of experience with ATV repeater design since he built most of the original Dayton ATV repeater. We formed the repeater technical committee and started kicking around ideas. We have plenty of UHF voice repeaters in the area and a number of accomplished EME operators (K9KFR and AF9Y). Keeping in mind that we were the "new kids on the block" (along with Bruce's blood-curdling tales of in-band repeater problems on 440 MHz), we decided to go crossband with a 439.25 MHz input (lower vestigial sideband).

Now, did we want to go with an output on 1.2 GHz or 900 MHz? The 1.2 GHz band always seemed to be a good band, equipment was available, and the band was not threatened with extinction. However, could enough interest be generated to inspire lots of hams to go out and buy downconverters for that frequency to watch ATV? Probably not too many. A few visits to the local K-Mart and Wal-Mart stores provided us with an economical solution. The Gemini "Rabbit" wireless video system operated on the 900 MHz band and was available for under \$50 (some stores sell just the receiver for substantially less). Not only do you get a high quality downconverter, but a transmitter is included as well. With the wide availability of these inexpensive units we decided to go with a repeater output on 910.25 MHz [Ed. Note: Next month's column will describe how to install external antenna connectors on these units and tweak them up for best results.]



Photo A. The W9TE ATV repeater was on display at the Summit City hamfest just before final installation. (Photo by Jim Pliett K9OMA. The photographer can be seen on the TV monitor.)

The Antenna System

Although vertical antennas are easy to obtain or build, we opted for horizontal polarization on both bands for added isolation from all of the nearby UHF repeaters that use vertical polarization and the services in the 900 MHz band that are also vertical.

Adolph WA9WTJ was given the task of designing and building a pair of horizontal omni-directional antennas (one for each band). Adolph decided to go with an Alford slot design, which allowed the antennas to sit on top of each other. Two- and four-inch diameter thin-wall tubing was obtained from local manufacturing companies and we found some scrap aluminum stock for the support collars. The radomes were built out of drainage pipe we bought at a farm store. To maintain the necessary accuracy for the slots, we had to hire a machinist. Since we had pretty much blown the budget by now, one of our members volunteered to machine the aluminum support collars.

Repeater Assembly and Installation

All of the hardware was tested and installed in the equipment rack. After some final tweaking and two revisions of the repeater controller's software, we were finally up and running with a working repeater (at least on the testbench). See Figure 1 for a block diagram of the final configuration of the W9TE ATV re-

peater. The 5-10 watt driver amplifier was built by Bob Johnson K9KFR. Although Bob used discrete components in this design, he recommends an easier approach using a new 10 watt linear brick amplifier that is now available from Down East Microwave, Box 2310, RR1, Troy ME 04987; Tel.: (207) 948-3741 (ask for the Hitachi PF0011 module).

The 100 watt amplifier is a Varian Eimac CV2810. These amplifiers are somewhat rare, but they turn up occasionally at hamfests or in surplus stores.

Success

At last the big day arrived. The club had amassed a 500-foot roll of 7/8-inch hardline for the installation. It was amusing to watch us try to wrestle with this giant coil of coax as we unrolled it and snaked it up two floors to the tower base. School regulations required us to dig into the club treasury to pay for a bonded tower climber, however. The antenna and coax was installed without a hitch. We opted to side-mount the antenna just below the top of the tower, hoping to be a lesser lightning attractor. A few days later we carried the repeater rack up three flights of stairs, hooked up the coax and fired up the transmitter. We were rewarded with a perfect 1:1 SWR (another perfect antenna design by WA9WTJ). Bruce WB8UGV headed home and sent the first picture through

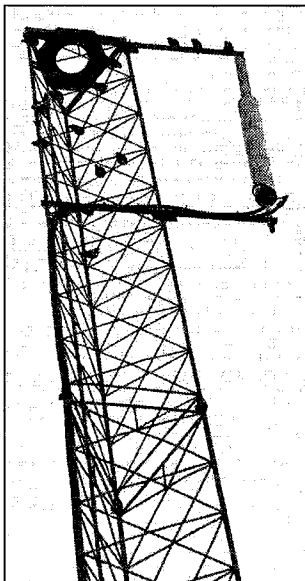


Photo B. Two Alford slot antennas (one for 439.25 and one for 910.25 MHz) are stacked on top of each other and side-mounted on the tower. Birds just love it! (Photo by Jim Pliett K9OMA).

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Solid-State Surplus Amplifiers

This month I would like to cover some little gems that have recently started to appear on the surplus markets—miniature RF amplifiers. These used to fall into the general category of "UNOBTANIUM." Regular readers know that unobtainium is usually relegated to the pages of defense industry microwave journals and very tough to find in surplus. However, these miniature RF amps are suddenly beginning to show up in surplus lots more and more often.

Perhaps the most outstanding feature of these little amps is their price tag—enough to make any accountant cough. But that does not detract from their beauty because they exhibit great gain and very low noise figures. They are especially attractive if they are found in the surplus markets and have frequency ranges that cover our amateur microwave bands. One drawback to note: These amplifiers are most often hermetically sealed, making modifications virtually impossible.

I have purchased quite a few of these amplifiers so I thought I would share some of the information that I have gained from the experience. When shopping for these devices you should keep in mind the old adage: "All that glitters is not gold." Take it from me, they are not all created equal. By that I mean some make very good doorstops. If you have a blown one, you can machine the top cover off to reveal a very interesting design structure (Photo A). Many of these have intermediate stages that still function but have no output due to a fried input or output stage. Some draw no current at all. So I must advise that you make a careful evaluation of unknown amplifiers.

For many of us, these amplifiers are real strange as far as their construction goes. They are assembled by microscope, using micro positioners. Never does even a small soldering iron touch their circuits—the amps are just too small. The circuitry is usually attached by miniature gold wire and welded by

micropositioners. Take a look at Photo A. This is a picture of two amplifiers I purchased at local swap meets. For display purposes I have placed one defective amplifier, with its cover removed by a milling machine, on top of a good amplifier for comparison.

The amplifier that functions provides gain from 10.4 GHz to 18 GHz according to the manufacturer's label. But I tested it on my workbench and observed gain from 6 GHz to over 20 GHz with rolloff which was not too critical at those band edges. The remarkable thing about this amplifier is that the overall gain is 30 dB. Its maximum output power is also +30 dBm, with drive power of zero dBm. That means a standard signal generator can drive this amplifier to full output of +30 dBm or 1 watt power output. Still, this unit is so small it can fit in a flip-top cigarette box. They're quite miniature for the power and gain punch they pack. Please note that an external heat sink is required to operate these little amps.

Look at Photo A again. Upon close inspection, what appears to be large blocks centered about the direct line between the SMA coaxial connectors is actually very complex circuitry. Each small block is actually a complete push-pull transistor chip substrate circuit mounted in the space of a pencil eraser cross-section, way less than a quarter of an inch in area. A jeweler's loop or magnifying glass is needed to see this circuitry. You really have to see one in person to appreciate it. Then you can understand why they need a microscope to put these together.

The Repair Job Learning Curve

One example of a repair job that proved interesting was on the mini-amp shown in Photo A., which I opened up after it drew no DC current. Upon investigation with a magnifying loop eyepiece I found a DC input lead broken. Attempts to re-attach it with a soldering iron were met with failure. Every time I tried to solder the gold wire it melted. I tried to re-connect it to the bypass capacitor that served as the connection post for the main DC power. I used a single strand of AC zip cord to terminate on the chip capacitor. It measured only 0.15" square but was

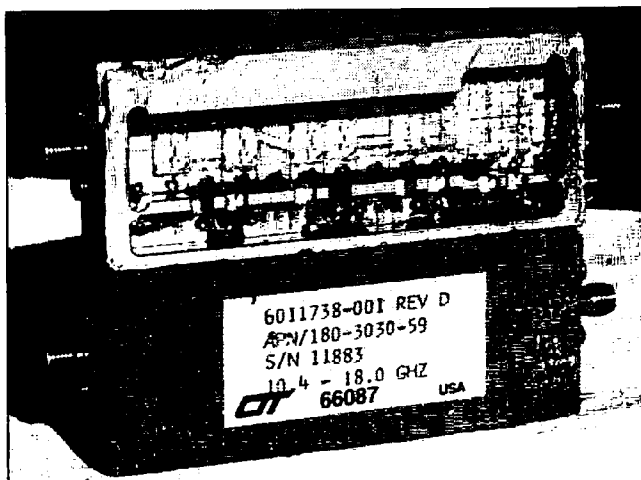


Photo A. Two 10.6 to 18 GHz amplifiers. The unit on the top was cut open to show the assembly technique.

still very large by comparison. My attempt to re-connect the gold wire failed, and trying to solder it with a 5 watt iron (my smallest) to the top of the chip cap was futile. What finally did work (for a while) was using two common sewing needles like chopsticks. I was successful in winding the gold wire around one single strand of zip cord.

After all this experimentation, the amp that was totally dead is now drawing current but still has an output stage failure. By checking with a probe and driving the input of the amp I was able to see gain increase by moving the probe from the input stage to successive stages. Now, this is an extreme case, but consider the learning experience. It proved to be a valuable lesson of how *not* to make a silk purse out of a sow's ear. All kidding aside, it was a valuable lesson and the information gained on how it was constructed alone was worth the trouble. Systems like these and how their various components work together are often valuable tools for discovery.

Let's look at another example. This one is also a tiny amp which uses SMA connectors and fully hermetic housings. The second amplifier is also made by CIT. It has a date code of 66087. I'm not sure what it all means but it seems safe to assume the "87" refers to the year it was made. While testing this amp, I found that with -10 dBm input power driving the amp I got +27 dBm output. That's a 1/2 watt of output power. I checked out the frequency range. It was from 4 to 8

GHz—exactly as written on the label. This amp rolled off fast at its band edges.

Increasing the drive until output compression started and then just backing off a tad produced an output of 1 watt at -1 dB drive. Higher drive levels took the amplifier into compression and produced no more output. DC power requirements were +15 volts at 1.3 amps. The amplifier is linear and capable of SSB, FM or even video if you want. What you put in is what you get out. You see a true reproduction with gain, just like a linear should give you.

What does something like this cost? Well, without the quantity price breaks, similar amplifiers sell for around \$1,800. So, if you can't find one in surplus, they are available from the manufacturer. All you have to do is use some plastic credit and order one. I personally prefer to shop the surplus markets and wait for new toys to arrive. I paid \$20 for the privilege to play with this one, without guarantees.

The packaging styles that I have just described are not the only ones to watch for, but they are an indicator of what may be inside. Take Photo B, for instance. It's an amplifier from Dexcel which was made to cover 8 to 10 GHz. I had no idea what this amp would actually do, but it's still a good example of what to look for. (It cost me \$10 at a swap meet but came without a guarantee.) The first things to identify are the two SMA coaxial connectors, the single power connection, and the ground ter-

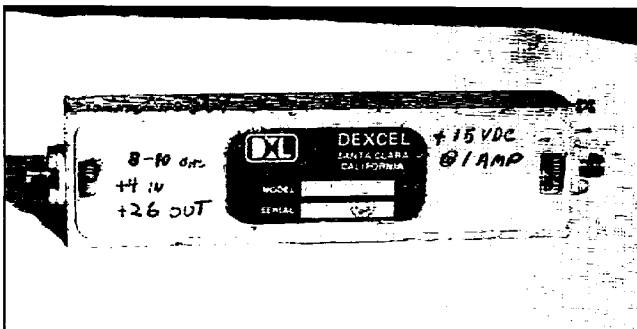


Photo B. Sample of a Dexcel 10 GHz amplifier.

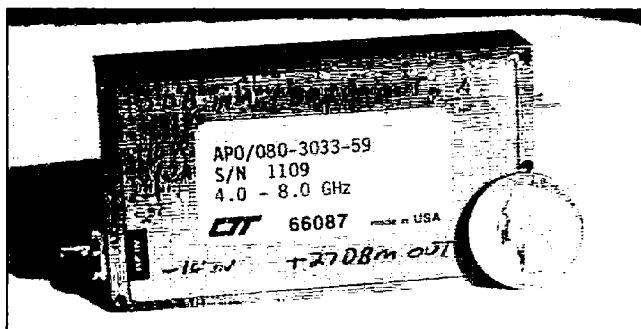


Photo C. A compact CIT 4.0 to 8.0 GHz, 1 watt amplifier.

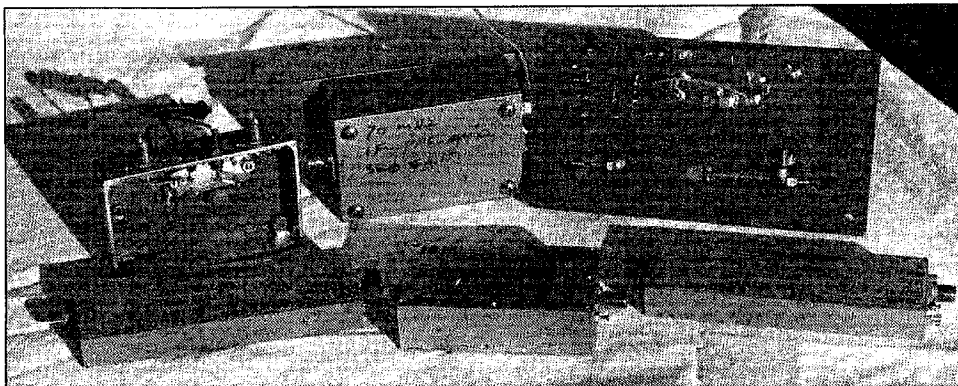


Photo D. These amplifiers were purchased at a swap meet. Sometimes you can find treasure this way, but not always.

minimal. You have to figure these SMAs are costly connectors and for a manufacturer to use them indicates they expect high performance in the microwave range because they would not waste the money on low frequency stuff. More importantly, we know this is not a filter or some other "passive device" because they provide DC power feed through capacitors, one of which is marked "+15." My rationale is: If it's not too expensive, give it a shot.

One thing to watch out for when evaluating surplus components is look-alike solid-state switching relays. They have several SMA connectors and multiple power pins. Don't confuse these with amplifiers! It's easy to make

this mistake because many are not clearly labeled. For example, a solid-state switch (SPDT) would have three SMA connectors, one or two ground posts, and two DC power pins. (One power pin is required for each direction you bias the diode switch. One is positive and the other is negative or ground. This is to allow the common continuity to the diode that is normally positively biased on with a few mA of current.) But let's get back to RF amps.

There is some risk in buying surplus, of course. You have to have faith that the seller isn't testing them all and just selling those in better need of an autopsy. In this case, with the two SMA connectors, DC power connectors, and

moderate price, I bought it. To test it I put it in my drill press bench vise, which serves as a heat sink, and applied +15 volts of power. It drew 1 amp of current. Driving with my sweep oscillator I was able to get just about 1/2 watt output with a few mW drive (+3 dBm). It was alive!

This amplifier was similar in many respects to the ones I mentioned earlier, except for size. This one was quite a bit larger, roughly 1" x 1" x 6". The point I want to make again is what to look for. The SMA connectors and power pins are the minimum requirements. Then you are on your own to evaluate what other information may or may not be marked on the prospec-

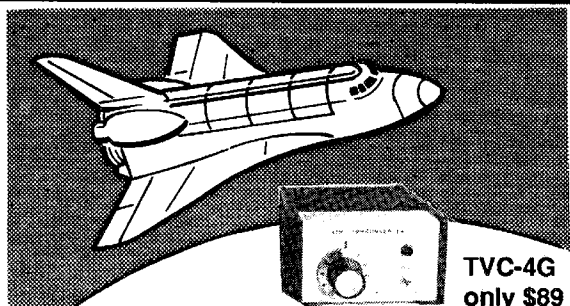
tive module you happen to be appraising.

In the case of this device, I figured out the power connector and found that when I applied DC power it drew about 1 amp. I then slowly increased the frequency on my sweep oscillator, keeping the drive level to -10 dB during initial testing. I found the output centered around the 8 to 11 GHz range. The amplifier had 22 dB gain with output power of about 1/2 watt throughout that frequency range.

Another unit that I picked up from surplus is the CIT power amp shown in Photo C. In this case, the label tells most of the story. With some units you just have to apply power and signal, but be aware that not all units will test the same. You just have to take the plunge and hope you didn't pay too much for these units. If the seller is asking for big bucks, inquire about the guarantee. If the dealer is reputable, you will be given a guarantee, or at least be allowed to test it before buying.

Testing before purchasing is a good option. It assures the purchaser that the unit operates, and also provides a good cover of protection for the seller. If a shop test is used the seller knows what is there and can prove it. With all surplus material, however, the guarantee is pretty much over at the end of the driveway. The seller is protected from someone abusing the unit or otherwise destroying it with reverse voltage in testing or some other unfore-

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seen event. This seems to be a reasonable policy if the parties to this transaction are not located too far from each other.

Let's go back to the amp in Photo C. In this case the amp had all parameters posted on the unit for frequency and polarity of DC power, but gave no clue of output power or gain. On the testbench I found that with -16 dB drive (input power) I could obtain 1/2 watt at the output. By raising the drive to near 0 dBm I obtained +30 dBm or 1 watt of output power before gain compression started. That's the maximum that the amp can tolerate, as it will give no further increase in output. This amp is tiny—I placed a quarter next to it for size comparison. The unit measures 3-1/2" x 2" x 3/4".

Power dissipated is 18 watts, so an effective heat sink must be used to keep the amplifier cool. If it is not used you will destroy the unit in short order. The preferred method is mounting it on a block of aluminum with heat sink grease. Note that in Photo C there are six mounting holes for attachment to a heat sink.

Photo D shows several amplifiers I purchased at a swap meet. The long-looking devices on the bottom left and bottom right are excellent doorstops. They were high gain 5 to 8 GHz units made by Raytheon for military application, but they showed very low gain and absorbed large amounts of power from the power supply (16 watts DC). I did not follow my general rule and got

bitten on this one. I will have to have peanut butter sandwiches for a week or so to fully recover from this experience.

The other amplifiers in Photo D include a MIC amp (top left) for DC to 500 MHz, a 70 MHz IF amplifier with 32 dB gain (center top), and a homebrew 2 GHz amplifier of stripline construction. The bottom center unit is a 2.3 GHz amp, with 30 dB of gain, by Amplicia. The point in showing these is to highlight some of the various styles of amplifiers in use today. I wish you good luck locating some for yourself. Keep your eyes open at swap meets and other events. I have one friend who goes to swap meets with his wife and they snatch up everything they can find that sells for a buck or two that is small and has two SMA connectors and a power pin. True, he has an impressive collection of door stops. But so far they have only spent \$10 on junk, and about \$30 or so on real fine units.

Of course, the market is not limited to just amplifiers like these—they may be the exception. Other types are available; you just have to keep your eyes open. I have been able to pick up amps that work in the range of 30 MHz to several GHz. They are all usable—I use the low frequency amps for IF work and the higher frequency amps for RF work. If you are as lucky as I have been you will soon have more amplifiers than you can use. Your worst problem will be trying to store all

this stuff. That's why I stress *small* on my list of requirements.

I violated this rule at the last swap meet when I found a unit that weighed over six pounds, heat sink included. It had a BNC and an N connector with power pins. The price was right, so I picked it up. It was covered with grimy dirt from the blower attached and lots of use. The label on top of the unit was obliterated and defied identification. The object on the heat sink was only 6" square and 1-1/2" high—very small for the heat sink it was attached to. I removed the basic unit from the heat sink and removed the 35 4/40 screws holding the top cover down. What I saw upon lifting the cover defied reason: It was a very complex microwave transmitter complete with oscillator.

After intense investigation I determined that this unit was a video transmitter converting video to RF directly. Internally it had two duplexers for two channels of audio to ride along with the video. Since it was about eight years old it used transistor frequency multiplication to about 1.7 GHz, where it fed a dual-channel, high-power varactor multiplier. The interesting part of this story is that when I applied 24 volts DC power, it drew 4 amps and put out +43 dBm at 4.9 GHz into a dummy load. Power of +43 dBm is 20 watts of power! Looks like the unit is good from 4 to 5 GHz so plans are in the making to see if it can be adjusted to the 5760 ham band as a video transmitter. What else can you say but, "WHAT A GOLD

MINE!" It doesn't happen all the time, but sometimes it does happen. Now if I can only figure out the lottery numbers . . . just dreaming.

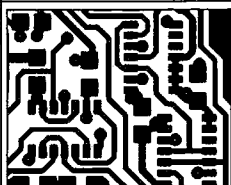
Mailbox

Jack N700, of Serria Vista, Arizona, wants to use 10 GHz full-duplex on a data link for experimentation. He has several intruder units manufactured by Raycom to test. His transmit units run on 78 volts DC. Can these units be modified? Well, Jack, it sounds like you have an Impatt diode oscillator, indicated by the 78 volts. That's what these diodes take for operation, 75 to 100 volts DC. Each diode has a specific critical voltage to set oscillation current—limited to a particular mA value for that diode.

Some units have to be adjusted lower in frequency by metallic screws penetrating further into the cavity. I have seen some Impatt sources that require dielectric tuning screws which have to be inserted into the cavity to do the same thing. In that case we used a Nylon 10/32 screw to do the required tuning. A little experimentation is needed to solve your particular unit's frequency adjustment. I just have not seen these Raycom units.

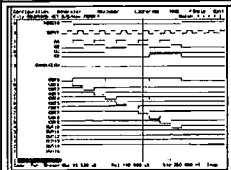
Well, that's it for this month. Next month I plan to get into another type of amplifier, the Log Amp. As always I will be glad to answer any questions relating to this or other aspects of VHF-to-microwave operation. Please send an SASE for a prompt response. **73**

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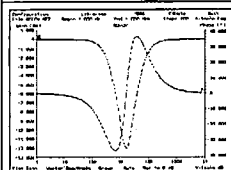
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PD-440N-3	"	"	NO	"	3-4W = 60W	T/R 199
PD-440NM	"	"	NO	"	3-4W = 60W	T/R 235
PD-440NM	"	"	NO	"	1/2W = 6W	T/R 75
PD-900N	902-928 Mhz	"	NO	FM	1/2W = 10W	T/R 118
PD-900N	902-928 Mhz	"	NO	FM	1/2W = 10W	T/R 90
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PD-33LHP	902-928 Mhz	"	NO	"	1W = 16W	T/R 299
PD-33LHP	"	"	NO	"	1W = 6.5W	119
PD-33HHP	"	"	NO	"	6W = 15W	125
PD-33VLP-1	"	"	NO	Hybrid	5mw = 8W	123
PD-33VLP	"	"	NO	Linear	1/2W = 1.5W	59
PD-33 Doubler	70cm = 33 cm	"	"	"	1/2W = 1.2W	65
PD-1200N	1.2GHz	Preamp	NO	"	1/2W = 1.0W	85
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The End of Oscilloscopes

For the past couple of months, we've been examining the nitty-gritty of using that wondrous window into the wacky world of electrons, the oscilloscope. Let's finish it up.

Just a Short Delay

OK, you've got your waveform frozen on the screen. Great! You're all ready to go. Hmmm, the part you want to see is awfully small and squashed. Wouldn't it be nice if you could stretch it all out? Well, sure, you can speed up the sweep, but it's kind of annoying to have to switch it back to where you were after you're done. For quick time base increases, most scopes have a "time base magnification" button. This multiplies the speed of the time base by 10 (or sometimes by 5, depending on the scope) and lets you return to your original setting just by pressing the button again.

Uh oh, wait a minute, now the part you want to see is off the right side of the screen, lost in space somewhere. How do you get it back? Slow the sweep back down. But now everything's so crunched together that all the detail is lost again; it's just a tiny blur and you're right back where you started. It would seem like there's no way out of this dilemma, but there is. It's called *delayed sweep*.

What you really need here is to trigger on your selected trigger point but not start sweeping until later on in the waveform, right? Delayed sweep lets you do that. First, you set up your waveform so that what you want to see is on the screen, but too small. That way, you know you have a stable trigger point. Then, you use the delayed sweep controls, which are just like the main time base controls, to start the sweep later in the signal. The effect is like looking through a magnifying glass. As you turn the sweep delay control, the signal zooms past as if you had a really long screen. Any time you work on a signal whose period of repetition is very long compared to the high frequency components (again, a TV signal is a great example), delayed sweep is an absolute necessity. There are lots of low-cost scopes that don't include this handy feature, but I strongly recommend you get a scope that has it, even if you don't see a need

for it now. You will, I promise.

Cursors

Some newer scopes provide on-screen cursors which let you select various points in your waveform for measurement. You can, for instance, easily measure the time between any two points or select a point and read its voltage. Usually, the result is drawn numerically right on the screen. Although these cursors don't give you anything you can't get yourself with a little more work in interpreting the screen, they speed things up and take some of the burden off of you. They're nice but unessential. And they usually add a few hundred dollars to the price of a new scope.

Memories . . .

Light the corners of my workbench. Well, not my workbench, but some people's, especially if they have a fair amount of money. I'm referring to digital storage, which, for some applications, provides the ultimate in oscilloscope utility.

Digital storage scopes have been around for many years, but they still are too expensive for most of us. I've never seen one at a hamfest, either. (But I keep looking!) Digital scopes work in the same way as any other digital recording devices. They use an analog-to-digital (A/D) converter to digitize the incoming signal. Then they store the bits in memory. After that, the information is read out and displayed as a trace on the screen. Why bother? The beauty of the system is that you can do things to those bits while they are in memory. You can measure the values they represent, perform mathematical operations on them to remove noise, or do just about anything you can imagine. Also, you can keep those bits as long as you like and even store them on a disk without any signal degradation. And, your input signal can be a one-shot event and you can still see it long after it's gone! Sounds like electron utopia, huh? Well, not quite . . .

A Mess By Any Other Name

In order to accurately represent a signal in digital form, you have to sample it at a rate that is at least twice as fast as the fastest component of the signal itself. This basic tenet of sampling theory, called the Nyquist Rule, is the reason why compact discs sample at 44.1 kHz (because the highest audio frequency of interest is 20 kHz). It is also the reason why digital sampling devices

always have low-pass filters at their inputs to reject any incoming signal components which are faster than half the speed of their A/D converters. It's absolutely necessary to do that because, if any of the unwanted signal frequencies get through, they will cause incorrect A/D conversion and result in an odd form of signal distortion known as "aliasing." Aliasing is the electronic equivalent of the strobe effect. You've seen that any time you've watched TV or a movie and seen car or wagon wheels appear to go backwards. The wheels were going much faster than the frame rate of the sampling device (TV or movie camera), so portions of their rotations were missed between frames. The result is that the wheels' positions were depicted at various points along their paths, implying a speed or direction of rotation which never really occurred. That's aliasing, and it can make an electronic signal appear totally different than it really was.

Equivalent Is Not Equal

On a digital scope, the limiting factor in the instrument's ability to "grab" fast signals is the speed of its A/D converter. Just a few years ago, an A/D converter which could digitize megahertz-rate signals was prohibitively expensive. We're talking hundreds of dollars here, just for the converter. So, in order to make commercially viable digital scopes, designers turned to a compromise method called "equivalent-time sampling." In this technique, the converter is made to sample a small piece of the signal which has been frozen in a preceding circuit called a "sample and hold." Each time the signal repeats, the converter samples the next small chunk, building up a digital representation of the total signal over many periods. This method of using a sluggish converter to digitize a fast signal does work, but it has a big disadvantage: The signal must repeat, and be exactly the same, over a fairly long period of time or the resulting digital representation will be wrong. So, equivalent-time sampling works fine for simple things like sine waves, but it is useless for complex waveforms which change a lot, like TV signals or digital pulse trains. Still, it is handy.

These days, 20 MHz converters are fairly cheap, and even faster ones are coming down in price all the time. So, a true-sampled 10 MHz scope is not prohibitive, and that same scope can offer equivalent-time sampling to perhaps 50 MHz or more.

Because of the aliasing issue, digital scopes take more understanding to use than do analog units. The only way to be sure you're really seeing the truth is to have

some idea of what *should* be there in the first place!

Some scopes offer both digital and analog modes in the same box. They ain't cheap, but they offer the best of both worlds. Ah, if I only could afford one . . .

The Future

Considering the proliferation of pocket LCD TV sets, you might wonder why you can't buy a pocket LCD oscilloscope. Well, you can! That is, if you have some serious bucks. I've seen ads from two companies making them. One sells for about \$1,100, and the other, with more speed and features, goes for about \$2,000. As E.T. said, "Ouch." I strongly suspect that, if more people knew how to use scopes, the market would drive the price down and we'd see \$100 basic LCD scopes at Radio Shack, just as once-exotic digital multimeters can now be had for as little as \$25. I know I'd be first in line to get one.

Also, there have been several "computer scope" products which allow you to use your personal computer as a scope. These boxes contain the A/D and other required hardware and present digitized information to your computer, where application software lets you manipulate and display it. It's a great idea. About six years ago I had a computer scope made by Heath. It worked great but I strongly disliked using it, primarily because it used a serial interface at 9600 baud, resulting in slow, snapshot-like traces on the screen. Also, it had a slow A/D and relied heavily on equivalent-time sampling. A good, fast, converter and a parallel or SCSI interface would have made all the difference. Still, it was a useful, if frustrating, box.

Well, I think we've covered just about every knob and button on an oscilloscope. I hope I've enticed you to think about getting a scope, or to pull that dusty one out of the closet and fire it up. Now, let's look at a few letters:

Dear Kaboom,

My KDK FM-2033 transmits but does not receive. After awhile it comes back to life and works fine. I checked for bad solder joints, but no luck. I don't have the manual, and KDK is no longer in the US. How can I fix this thing?

Signed,
At A Loss

Dear At,

I'll bet if you measured the frequency of the rig's transmissions when it is not working, you'd find they were nowhere near where they should be! My bet is that your PLL is way out of lock and, for some rea-

son, the rig's out-of-lock detector is not catching it. It could be as simple as an adjustment, but I can't suggest anything because I, too, have no access to a manual for that rig. I strongly recommend that you put a notice out on packet and try to get a manual. Good luck—I hope you find one.

Dear Kaboom,

About five years ago I bought a Mollicell rechargeable-lithium battery pack for my ICOM handheld. I still have it and it still works great! I once left it for six months and it retained about 85 percent of its charge. It seems to have no memory problem and is trouble-free; it's much better than NiCds. I'd like to buy another one but the supplier seems to have disappeared. What happened to this excellent product?

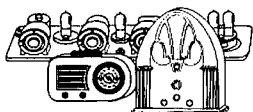
Signed,
Unrequited Love

Dear Unrequited,

I remember the Mollicell. In fact, somewhere I still have a key chain the company gave me at a product demonstration. Yes, they were great batteries. Unfortunately, they were quite a bit more expensive than NiCds. I don't know if that's the reason they didn't catch on, and I don't know if Mollicell is still in business or not. I do know that Sony has a rechargeable-lithium battery on its latest high-end mini camcorder, so the technology is not dead. If any of you out there know the status of Mollicell or their wonderful batteries, please let me know and I'll pass it along here in the column. Until next time, 73 de KB1UM.

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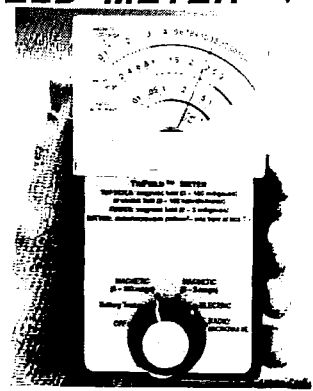
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Amie Johnson N1BAC
43 Old Homestead Hwy.
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Notes from FN42

Hey, guess what! Someone has been reading my column and told me the other day that he was taking my advice to get involved with helping others in ham radio. But, this guy has been very actively involved already. Gary KD1JR got involved from the very beginning of his amateur career, which hasn't been very long. He progressed through to Extra within a year and has been going hard ever since. And, not too long ago, he decided to get involved in the MARS program to be able to provide phone-patch service to many of our service people. Thanks, Gary, and keep up the good work! There's lots more news this month, so let's get to it! 73—Amie, N1BAC.

Roundup

Brazil This is a little bit late, but The Antenna-Electronics Popular magazine sponsored the World Wide South America CW Contest—WWSA/1993 June 12-13, 1993. Send your logs (with SAE/IRC for results) by July 31 to WWSA Contest Committee, PO Box 282, 20001-970 Rio de

Janeiro, RJ, Brazil. The WWSA CW Contest was created in 1982 and takes place every year on the second complete weekend of June. The WWSA is supervised by the well-known CW Groups Pica-Pau Carioca (PPC) and Morse Clube Gaúcho (MCG).

Republic of Korea Letter from Charlie R. Hopkins HL9FY: Hello to all! I am stationed at Osan Air Base with the United States Air Force. We have a very active amateur radio club, the American Amateur Radio Club of Korea. We have members who attend our meetings from all over the Korean peninsula. I am the treasurer of this organization and the volunteer examiner coordinator liaison for the ARRL testing group. I have been in Korea this time since December 1987 and am currently serving on my seventh tour. I got my original amateur radio license in May 1983 and came to Korea in August 1983. Shortly after my arrival, I requested a HL9 callsign. Prior to my departure from the U.S.A. in 1987, I wrote to the office responsible for issuing licenses to U.S.A. personnel in Korea and was fortunate enough to get my old callsign back, HL9FY. I wish to inform you that some people coming to Korea can get an amateur radio license. There are

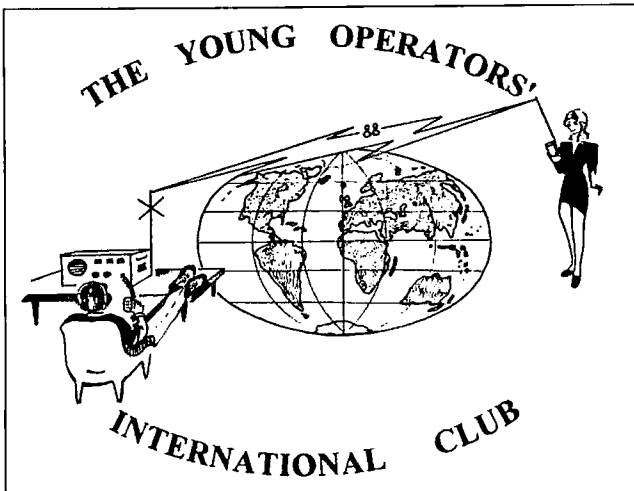



Photo A. The Young Operators' International Club's logo.

some requirements to be met. Before a person is eligible to get a HL9 callsign, they must be covered under the Status of Forces Agreement (SOFA) between the governments of the United States and the Republic of Korea. If they meet this criteria and have a valid U.S. callsign, they can apply for an operator's permit and get a station authorization.

Operating in Korea is a little different from operating in the U.S. There are no portable or mobile operations permitted for HL9 licensees. There are no (repeat, no) CB operations allowed

in Korea for foreigners. Furthermore, the installation of radio equipment (amateur or CB) in a privately-owned or government vehicle is prohibited.

The frequency allocations are different on some bands. Power is limited to 500 watts for the Extra, Advanced, and General Classes; 100 watts for the Technician Class; and 50 watts for the Novice Class. Just about all modes of operation are permitted: SSB, CW, RTTY, packet, SSTV, FM, and beacons, just to name a few. You must also maintain a log of contacts. A license, once issued, is valid until the



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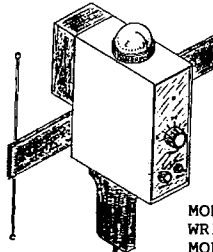
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person's DEROS (date of estimated return from overseas) is reached, the individual's stateside license expires, or the person leaves the country on a permanent change of station (PCS). If a person reaches his DEROS date but is extended, he or she must renew the license before the expiration date. The license date is not automatically extended with the service commitment extension. Any person coming to Korea who is covered by the SOFA agreement and would like more information on amateur radio operation may contact either myself or Mr. Andrew Lamb at the following addresses and phone numbers: SMSgt Charlie R. Hopkins, PSC #3, Box 5314, APO AP 96266-5314, 011-82-333-661-4750 (2300Z-0700Z), 315-784-4750 (DSN), 011-82-333-661-4620 (24 hour FAX), 315-784-4620 (DSN FAX) or Mr. Andrew F. Lamb, ACoS J6, ATTN: EAIM-O-OMT, APO AP 96205-0010, 011-82-2-7915-4160 (2300Z-0700Z), 315-725-4160 (DSN), 011-82-2-7913-3052 (24 hour FAX), 315-725-3052 (DSN FAX). Mr. Lamb or I can answer anyone's question(s) concerning getting a license in Korea. Please feel free to call or write if you need information. The phone numbers are listed as they would be dialed from a commercial phone, unless indicated as DSN. If you write, please note that an APO address is just like a stateside address and does not require international postage. Usually a three-to-four-page letter will only require one 29-

cent postage stamp.

On a final note, a person may not apply for a HL9 callsign until they are physically in the country. So, if you are coming to Korea, pack up your rig and plan on getting on the air when you get here. A license can be processed in as little as 15-20 minutes. *[Wouldn't that be nice here in the U.S., rather than 6-8 weeks or more?—Arnie]* Andy and I are looking forward to hearing from the future HL9s and welcome you to "Korea: Land of the Morning Calm." 73 from Charlie HL9FY, AARCK Treasurer, AARCK ARRL VE Liaison.

Russia Letter from Andrei Trubachov UA3PIP, organizer of YOP: The Young Operators International Radio Club (YOP). The YOP is an international organization of young people, intended to promote friendship and a better understanding of one another by sharing ideas about radio and other hobbies through radio communication and a newsletter.

The idea of organizing the club came to me after about five years of activity on the ham bands. While trying to improve my English by talking with other operators, I found that about 95% of them were over 40 years old, particularly on CW, where after a number of contacts I began wondering if radio was just a place for retired people! This age difference is probably one of the reasons why the young guys I met became such good friends. So, why not try to bring young

hams and SWLs together through an international radio club? This would be a good opportunity for them to communicate, since many have VHF-UHF licenses or only receivers. Also, the boys and girls who are not yet licensed and are trying to get into amateur radio would be welcome to the club. A newsletter or small magazine will be published so that members may share their ideas about radio, as well as other interests, including computers, travel, music, etc.

So, if you are under age 30 and enjoy ham radio, join us and let's have fun together! Send your photograph and a brief description of yourself to: Mike Page! WB9QFW, University of Wisconsin, Stevens Point, WI 54481 U.S.A. [Andrei "Andy" Trubachov UA3PIP, 301264 Russia, Tulsakaya Obl. Lipki, UL Gagarina 10, K. 14]

HONG KONG

Phil Weaver VS6CT
Flat 39C Two Park Towers
1 Kings Road
Hong Kong
Eric Lee VS6EL, a keen and enthusiastic amateur since 1977, is up and leaving for Australia. By the time you read this he will have set up home in Sydney. We are sorry to see you leave us, Eric, but wish you well in your new home and hope that we shall be hearing from you when you get on the air soon.
Christmas is behind us and both clubs had excellent Annual Dinners. As

a result, talk is already in progress about next year's dinner. It was noted that perhaps we might have a joint Annual Dinner, but at a recent meeting of ELARCS it was felt that, as this is the only major social event of the year, and because we did not wish to lose our identity, the vote was all in favor of retaining our existing arrangement. We have already made a booking for the first weekend in December at the Royal Hong Kong Yacht Club again. This does not mean to say we would not wish to have a joint annual event. It was suggested for further discussion between HARTS, JAROC.NH, and ELARCS that perhaps a Spring Chinese Dinner might be the way to go in 1994, without chasing door prizes but just to have a pleasant social gathering of all the various elements of amateur radio under one roof. If you, our readers, have any ideas or proposals in this matter, please approach your club committee members with your ideas.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel
Hi to all. The June issue of 73 marked the tenth anniversary of the publication of my first contribution to "73 International." Amazing how fast those years have breezed by and how the scores of my contributions have added up. Going through the back issues shows how much ham radio has

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developed in my country in so many different areas. I don't know for sure, but I would hazard a guess that I'm your most veteran Hambassador still appearing regularly in the column without a break.

For the record, I am 43 years old, married with one child, an electrician by trade, have been a farmer, and still participate from time to time in the agricultural ventures of my kibbutz. I've held a ham license since 1965, RF being a long-term addiction that I have not succeeded in shaking. I've dabbled in many facets of the hobby over the years, including 160 meters DXing and general HF Dxing and rag-chewing, and built all my own antennas. My latest interests in the hobby are satellites (mainly OSCAR 13) and VHF packet. I am also an artist, with paintings mainly, but not exclusively, celebrating the plains of the western Negev region of Israel. Some of these paintings may be found in private collections in Israel, Holland, the U.S., and Canada.

From time to time a reader will write me with a specific request for information or with a desire to set up a sked. The demands of a busy, working life do not allow me to accede to all these requests as time is a very scarce commodity. However, over the past 10 years I believe that I have covered almost every facet of Israeli amateur radio, and looking up the back issues of 73 will provide most of the answers.

OKINAWA, JAPAN

David Cowhig 7J6CBQ/WA1LBP
AmCon Naha
FBU PSC 556, Box 840
FPO AP 96372-0840

The China Radio Sports Association strongly encourages home-brewing by Chinese hams. One enterprising Chinese ham in Shandong Province found a pre-1949 ham radio book and built a working, but unfortunately chirpy, two-tube transmitter with which he worked Chinese and foreign stations. Unfortunately, the parts, the test equipment and the level of these beginning Chinese home-brewers are not good enough to build home-brew equipment which meets the strict Chinese signal stability and bandwidth requirements. A *CQ Taiwan* ham magazine article concludes that once Chinese hams are able to buy fairly simple transceivers, their persistent efforts to learn foreign languages and CW will put them in touch with hams worldwide. The author predicts that Chinese ham radio will one day be as flourishing as Japanese ham radio.

Sending Chinese hams copies of some of the best home-brew construction articles which have appeared in US, Japanese, and other ham magazines is one way foreign hams can help. The language barrier and the difficulty of adapting a design to locally available parts are obstacles to the Chinese home-brewer, however. Perhaps Chinese magazines could reprint

some of the best articles from foreign ham magazines if reprint permission could be arranged.

There is now no national ham magazine in the PRC. One very popular radio and electronics magazine, *Wuxiandian [Radio]*, published by the China Electronics Association and the Renmin Youdian Chubanshe, does devote a few pages to ham radio each month. The address is *Wuxiandian*, Dong Changan Jie 27, Beijing, China. Perhaps ham magazines outside China could arrange with *Wuxiandian*, and whatever other Chinese radio, electronics or ham magazines that will soon appear, to exchange permissions for non-exclusive translation and reprinting of articles without prior notification, just as 73 and the CO Publishing Co. of Japan have done for several years. In this way, the Chinese magazine can make whatever parts substitutions and design changes are needed so that Chinese readers too can find the needed parts more easily and cheaply in their own area. A subscription to this Chinese language electronics repair technician oriented magazine can be obtained through the Joint Publishing Co., 9 Queen Victoria St., Hong Kong.

The China Radio Sports Association (CRSA) wrote the "Provisional Rules for Regulating Individual Amateur Radio Stations" at the request of the Chinese government to provide a framework which permitted the start of individual amateur radio station opera-

tion using the BA, BD, and BG prefixes on December 22, 1992. These rules provide that all hams shall be a citizen of the PRC of at least 18 years of age, that radio equipment meet national radio emission standards, that the equipment and station be inspected by the provincial or special municipality CRSA, and have proper documents from the CRSA when buying equipment, home-brewing or modifying equipment. The rules require on-air politeness, exchange of QSLs for international contacts, and forbid the use of amateur radio to promote business, political or religious activities. Amateur prefixes indicate license class: BA is for a First Class licensee; BD belongs to a Second Class licensee; and BG is for a Third or Fourth Class licensee. These new home ham stations are often home-brew and run low power. Listen for them!

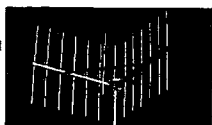
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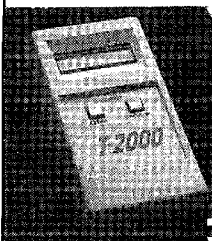
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der to avoid getting you confused. I am Chinese.

TUARC SPECIAL EVENT '93 . . . Having received the formal approval from the State Sports Commission of China, TUARC is going to establish a special event station—BT2000BJ—May 23 through 31 and July 1 through 31. This somewhat different callsign is exclusively dedicated to showing our wholehearted support to Beijing's bid for the 2000 Olympic Games. We will mainly operate on the SSB phone mode (and also CW and RTTY) on practically all HF bands, including 12, 17, and 30 meters, especially 10 MHz CW. This might be the very first time "BT" is on the WARC bands. TWINS . . . Failure and Success are twins—this is exactly what we have learned from the recent antenna construction. With an outstanding book on hand and with Dieter/DJ7BU's professional instruction, we got a Zepp antenna built and working on March 20, but later the haphazard weather during this time of year caused some more trouble and crushed our well-designed, good-looking cubical quad on April 18. Thanks to Dieter's confidence and our perseverance, we quickly recovered and bettered the two old beams on April 25. Another dipole was getting the attention of passers-by on May 1, a real "Labor Day." The original ground plane will remain and we may put up an inverted V before the BT2000BJ Special Event.

CLASSROOM . . . The antenna is

"everything" for working DX, but not everything for getting skilled ops to work DX. In order to get fully prepared for the high likelihood of pile-ups during the BT operation, Rick has started a 2nd session of the TUARC Amateur Radio Class and has gotten 15 more students involved. All of this group of boys and girls have a good command of English and a cooperative and progressive nature.

BT5HPW . . . Assisted by the Xinhua News Agency in Hong Kong, the Young Pioneers of China and the Hong Kong Girl Guides jointly started their North-American-Indian-type camp life in Hangzhou on April 5. A TS-50S and an AT-50 automatic antenna tuner were carried to the camping site, and the Special Event callsign BT5HPW remained busy on the air until the 19th of April.

LARRY AND JIMMY . . . Rick had a lovely chat April 30 with Jimmy BV4AS/7 and Larry BV7/N4VA, who were on their way to Penghu Island near Taiwan. Larry, as an American volunteer and the ITU Region 3 Coordinator, had just come back from his CW teaching in Bangladesh (S21). We wish Larry the best of good luck in whatever he'd like to undertake in the future and will look forward to learning Morse code from him sometime soon.

SUNSHINE COAST . . . TUARC is very grateful that the Sunshine Coast Amateur Radio Club (SCARC) in Australia sent out a quick response to our ham-related magazine request. Rick



Photo B. Ron Gang 4X1MK, who has been 73's Ambassador to Israel for 10 years.

was happy to be informed by Ron VK4DRC and Joe VK4GEL that a package has been sent via surface mail. "ALMOST" HAM VISIT . . . While busy working a European pile-up on April 3, Rick heard, "Hi Rick. This is Ken G3OCA, and I'm flying to Beijing May 5." Ken did make the trip but, because of a temporary change of his tour schedule, we were unable to have

an eyeball QSO. TUARC would like to thank Ken for the nice info and we'll see you next time.

Thank you for reading China Ham News. Any of your comments and/or suggestions are appreciated. If at any time TUARC can be of help to you, don't hesitate to ask. Remember that you have quite a few friends in Beijing.

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SPECIAL EVENTS

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Ham Doings Around the World

AUG 1

CROOKED LAKE, IN The annual Land of Lakes Angola Hamfest, sponsored by the Land of Lakes ARC, will be held at Steuben County 4-H Park from 6 AM-1 PM. Talk-in on 147.180; packet: 145.090; 444.358-131.8 tone; 224.94 and 53.050 Angola Rptrs. Contact Sharon Brown WD9DSP, 905 W. Parkway Dr., Pleasant Lake IN 46779. Tel. (219) 475-5897.

AUG 8

MINERALWELLS, WV The Mid-Ohio Valley ARC will hold their 5th annual Hamfest at the 4-H Campgrounds from 7 AM-4 PM. Talk-in on 146.745/145 and 443.050/1550. Contact Ron Ferrell WD8RGZ, (614) 423-5482, or Bill McClure WF8U, (304) 485-7777.

PEOTONE, IL The 59th annual Hamfest/Computer Festival, sponsored by the Hamfesters RC, Inc. of Chicago, will be held from 8 AM-3 PM DST at the Will County Fairgrounds. Talk-in FM STARS and KARS Rptrs. will be used: STARS 146.64, KARS 146.94, and 146.52 simplex. Club call is W9AA. Contact David F. Brasel NF9N, Hamfesters Radio Club, 7528 W. 109th Pl., Worth IL 60482. Tel. (708) 448-9432.

WHITE PLAINS, NY The Westchester County Center will be the site for the American Radio Relay League—Eastern

New York Section Convention. Sponsor: Westchester Emergency Communications Assn. Vendor spaces must be reserved in advance. Contact WECAFEST '93, Jeanne Raffaelli N2NQY, 544 Manhattan Ave., Thornwood NY 10594. Tel. (914) 962-9666.

AUG 13-15

VERNON, CT The 19th Annual Eastern VHF/UHF/SHF Conference will be held at the Quality Inn (on the Hartford Turnpike). To get a registration form, write (with SASE) to: Byron Blanchard N1EKV, 16 Round Hill Rd., Lexington MA 02173. For room reservations, contact Lori Tozier, (203) 646-5700. Special rate available.

AUG 14

BURLINGTON, VT The Burlington ARC will hold their BARC 41st Int'l. Hamfest at the Old Lantern Campground, Greenbush Rd., Charlotte VT. For camping info, call (802) 425-2120. Talk-in on 146.611/01, 146.94/34, 146.52 simplex. ARRL VEC Exams. For general info, call David Berteau, (802) 893-7660.

RHINELANDER, WI The Northwoods ARC, the Rhinelander/Tomahawk Rptr. Assn., and the ARRES, will co-sponsor a Swapfest at the Sugarcamp Town Hall (12 miles north of Rhinelander on Hwy.

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check Special Events File Area #11 on our BBS (603-924-9343), for listings that were too late to get into publication.

17), from 8 AM-3 PM. VE Exams at 9 AM; registration at 8:30 AM. Talk-in on 146.94 Rhinelander Rptr.; also, 145.43 Tomahawk Rptr. For table info, write to Glenn Woods N9GRF, 6569 Hillcrest Dr., Rhinelander WI 54501.

AUG 14-15

HUNTSVILLE, AL The 1993 Huntsville Hamfest/ARRL Nat'l. Convention, will be hosted by Huntsville Hamfest, Inc. at the Von Braun Civic Center, beginning at 9 AM both days. Talk-in by K4BFT will be on 146.34/94. Contact Huntsville Hamfest, P.O. Box 12534, Huntsville AL 35815. Tel. (205) 534-7175.

AUG 15

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club will hold a Flea Market from 9 AM-2 PM at Albany and Main St. Talk-in on 146.52, and 449.725/444.725 - pl 2A - W1XMR. Get details by calling (617) 253-3776.

EASTON, PA The Delaware-Lehigh ARC, Inc. Computer/Hamfest will be held at the Career Inst. of Tech. beginning at 8 AM. VE Exams. Talk-in on 146.70 W3OK Rptr. Contact Bill Goodman K3ANS, (215) 253-2745 or (215) 258-5063. Also call the DLARC Answering Service, (215) 820-9110.

QUINCY, IL The Western Ill. ARC will hold their Swapfest from 8 AM-2 PM at the Eagles Alps Lodge, 3737 N. 5th St. 1 mi N of US 24 and N 5th St. intersection. VE Exams. ARRL table. Talk-in on 147.63/03, and 146.34/94. Contact Rod Simon N9MCX, c/o WIARC, P.O. Box 3132, Quincy IL 62305.

AUG 21

ITHACA, NY The Finger Lakes Hamfest will be held at the Armory Bldg., Rt. 13 and Hanshaw Rd. The Tompkins County ARC will host this event from 7 AM-3 PM. VE Exams - No walk-ins - Register by Aug. 3rd. Talk-in on 146.37/97. Contact Ross N2ISU, c/o T.C.A.R.C., P.O. Box 4144, Ithaca NY 14852-4144. Tel. (607) 257-3511.

AUG 22

MARYSVILLE, OH The Union County ARC will sponsor their 17th annual Marysville Hamfest/Computer Show at the Fairground in Marysville OH (near Columbus). VE Exams on a walk-in basis only. Contact Don Sabins N8MGJ, 15704 Jolly Rd., Marysville OH 43040. Tel. (513) 642-0475.

ST CHARLES, MO The St. Charles ARC will host Hamfest93 at the

Continued on page 82

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HAM HELP

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We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. You may also upload a listing as E-mail to sysop, to the 73 BBS/Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit, (603) 924-9343). Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or I, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Manual/Schematic? B&K 445, EICO 379, EICO 330, SEMCOR RC115, TS-888. Marvin Moss W4UXJ, Box 28601, Atlanta GA 30358.

I am a Grade 7 teacher and for the past three years have been teaching Ham Radio as an extra-curricular class for Grades 6 to 9. On May 2, 1993, our supply room was broken into and the majority of our radio equipment, which consists of VHF and UHF gear, was stolen. Because of our limited budget, this equipment cannot be replaced, and therefore, we are seeking donations of any type. Your help will be

greatly appreciated. I will reimburse shipping and any other costs incurred. Please forward to Jay Goldring, 327 Seneca Ave., Burlington Ontario, Canada L7R-2Z8.

Wanted: Simple, inexpensive receivers or transceivers for 5.735 MHz USB, for 12 volts DC or less. Could be in kit form. Needed for use in Zaire, Africa for communication between churches. What are the possibilities? Keith Gustafson KB0DRU, BP 1377, Bangui, Central African Republic, Africa.

Can anyone provide me with schematics or manuals for the Gonset G-66B mobile receivers? I will gladly pay reasonable fees. Al Cikas KA9GDL, 412 Radford Dr., Sherman IL 62684.

Needed: Manual and schematic for a Tempo One SSB Xceiver. This is the Yaesu "white face" unit with transistorized VFO. I will gladly pay reasonable copy and shipping charges. Thanks and 73's. *Pretty Ogletree NONMC*, 3609 Bray Ave., Columbia MO 65203-0877. Tel. (314) 445-2662.

I am looking for info, manual and schematics, for a D&A Maverick HF amplifier. I have been unable to contact the company. If you can help, please call *Jim Hassen KB3ANX*, (301) 422-1209.

Dealers: Your company name and message can contain up to 50 words for as little as \$420 yearly (prepaid), or \$210 for six months (prepaid). No mention of mail-order business please. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '92 issue must be in our hands by February 1st. Mail to 73 Amateur Radio Today, 70 Rte. 202 N, Peterborough, NH 03458

Blanchette Park, 6:30 AM-2:30 PM. Vendor area open 9 AM. Talk-in on 146.071.67. Contact *Scott Schultz N0UVM*, 241 Burning Leaf Dr., St. Peters MO 63376. Tel. (314) 928-7267. VE Exam pre-registration: (314) 524-3254.

TOWSON, MD The 3rd annual Moose ARC Ham and Computerfest will be held 8 AM-4 PM at the Loyal Order of Moose, Towson Lodge 562. Talk-in on 145.330 and 224.12. Advance registration and info, Nick Nickles *W23J*, (410) 668-2363, or write: *Loyal Order of Moose, Towson Lodge 562, MOOSEFEST, 8801 Mylander Ln., Towson MD 21286.*

AUG 22-23

ALBUQUERQUE, NM The New Mexico Army Nat'l. Guard Armory, 600 Wyoming Blvd. N.E., will be the location for the Duke City Hamfest/ARRL Section Convention. Sponsors: The Duke City Hamfest and associated Clubs. Talk-in on 147.10 MHz Rptr. (+600 kHz), Rio Rancho K8BI. SASE to: *The Duke City Hamfest, P.O. Box 6552, Albuquerque NM 87197-6552.*

AUG 28

CHAFFEE, NY The PROS (Pioneer Radio Op. Soc.) will sponsor a Hamfest from 6 AM-5 PM at Manion Pk. Talk-in on 145.390 and 444.175. Contact *Paul Sumski KAZZMC, P.O. Box 334, Arcade NY 14009.* Tel. (716) 492-3198.

FREDRICKSBURG, VA Call *AC4SK* at (703) 373-7076; or *AC4MB* at (703) 891-5581, for details about VE Exams to be conducted at the Central Rappahannock Library.

GAINESVILLE, TX The Cooke County ARC, Inc. will host its 2nd annual Ham Fest at the Civic Center beginning at 9 AM Sat. morning. Set-up Fri. Aug. 27th from 4 PM-9 PM and Sat. Aug. 28th from 8 AM-9 PM. VE Exams, all classes.

GARDNER, MA The 1st annual Flea Market to be sponsored by the Mohawk ARC, will be held rain or shine at Mohawk Drive-In Theater. Talk-in on 145.370-600. Contact *Bill WJ1Y* at (508) 939-2643. Doors open at 0800 hrs.

MANVILLE, NJ The Somerset County ARS will hold its annual Hamfest at the Manville Civil Defense Bldg. at 60 Weiss St., starting at 8 AM. Talk-in on 448.175 (-5), 224.88 (-1.6), 146.53 simplex. Call *Ron Walkowiak N2RPK*, (908) 685-1191, 6 PM-9 PM; or *Pete Sepesi WA2OCN*, (908) 212-2890, 6 PM-9 PM.

ROSEAU, MN A Hamfest will be held by the Woods Rptr. Assn. at the Roseau High School Gym, Hwy. #11 E., beginning at 10 AM. VE Exams. Talk-in on 147.69/09 and 146.40/147.00. Reserve before Aug. 20th. Contact *David Landby KB0HAP, Rte. 3 Box 10, Warroad MN 56763.* Tel. (218) 386-1092.

AUG 29

LEBANON, TN The Short Mountain Rptr. Club will hold a Hamfest at Cedars of Lebanon State Pk., U.S. Hwy. 231, 7 miles S of I-40. Time: 7 AM-3 PM. Talk-in on 146.91. Contact *Mary Alice Fanning KA4GSB*, 4936 Danby Dr., Nashville TN 37211. Tel. (615) 832-3215.

YONKERS, NY Yonkers Municipal Parking Garage, on Main St., will be the location for the Hamfest/Computerfest being held by The Yonkers ARC, from 9 AM-3 PM. Talk-in on 146.865/R, 440.150/R, and 146.52 simplex. Get the details from *John WB2AUL*, (914) 963-1021; or *Jim N2ONM*, (914) 969-5182.

SEP 3-4

ALOMOGORDO, NM The Alamogordo ARC will hold its 9th annual Hamfest on Fri., Sep. 3rd, from 3 PM-9 PM; and Sat.,

Sep. 4th from 8 AM-2 PM. VE Exams will be held on Sat. at 9 AM for all classes; call *Ole Jorgensen WA5IPS*, (505) 437-5896. For Hamfest info, contact *Bill Lee-han N5SUM*, (505) 437-9781.

SEP 19

RAWHIDE, AZ Thirteen local Amateur radio clubs of Phoenix AZ will sponsor a Family Amateur Radio Event beginning at 10 AM at a Pavilion in Rawhide. Loads of events. Talk-in on 146.76. For details, write to: *FARE, P.O. Box 9219, Phoenix AZ 85068.*

SPECIAL EVENT STATIONS

JUL 29-AUG 1

OSHKOSH, WI Members of the Fox Cities ARC will operate *W9ZL* 8 AM-5 PM daily, from the Experimental Aircraft Assn. Fly-In and Convention (at the "Pioneer Airport" adjacent to the EAA Aviation Museum). Operation will be on the General phone portions of the HF bands, as well as RTTY and CW, as conditions permit. The Club will also be giving "on grounds" convention info on 146.520 simplex. To get a 8 x 10 certificate, send proper QSL and SASE only to *Wayne Pennings WD9FLJ*, 913 N. Mason, Appleton WI 54914.

AUG 1

SKOKIE, IL Members of the Orchard Village RC will operate *N9HEL* from 1600-2300 hrs., in the lower 25 kHz of the General 20, 15 and Novice 10 meter SSB subbands (depending on band conditions). Orchard Village is a residence for the developmentally disabled, and this station will give their radio club members (all studying for Novice class licenses) an opportunity to practice their skills, as well as demonstrate amateur radio to other residents and guests. For a QSL, send your QSL and SASE to *Gloria Beverly, c/o Orchard Village, 7670 Marmora, Skokie IL 60076.*

AUG 7-8

LANNON, WI Special Event Station *W9WK*, will be operated by the Milwaukee A.R.E.S., 0200Z Aug. 7-2000Z Aug. 8, to celebrate the 3rd annual "Picnic Ham" held at Menomonee Pk. Operation will be in the General phone and CW bands on 75, 40, 20, 15 and 10 meters. For a certificate, send QSL and a 9 x 12 envelope (with 2 units of postage) to *W9WK, c/o John Leekly, 757 N. Broadway, Suite 306, Milwaukee WI 53202.*

MT. DAVIS, PA The Somerset County ARC will operate *NJ3T* from the Highest point in Pennsylvania. Operation will be on the lower 50 kHz of the General class phone bands, on 10-80 meters as conditions allow. For a certificate, send QSL and SASE to *Jim Crowley NJ3T, R.D. 5 Box 223A, Somerset PA 15501.*

AUG 13-SEP 6

ISLINGTON, ONT., CANADA Station *VE3CNE*, Toronto, will operate 1400Z-0200Z, in conjunction with the Canadian Nat'l. Exhibition. Frequencies: Even hours: 14.015 MHz, CW and SSB; 14.150 MHz SSB listening; Odd hours: 7.020 MHz, CW and SSB; 7.075, SSB listening. For details and QSL response, mail to *VE3CNE, P.O. Box 307 Stn. H, Toronto, Canada M4C 5J2.*

AUG 14

MIAMISBURG, OH Members of the Mound ARA will operate *W8DYY* 1200Z-2200Z; the phone portion and Novice 10 meters, General portion of 20 and 40 meters, to celebrate the 175th Anniversary of Miamisburg. For QSL card, send SASE to *MARA, c/o Jeem Newland*

WB8RXI, 240 Carlwood Dr., Miamisburg OH 45342.

AUG 14-16

BENNINGTON, VT The Southern VT ARC will operate *N1JIF* 1400Z-0500Z, to commemorate the Battle of Bennington and the 3rd Anniversary of SOVARC. Operation will be in the 80-15 meter General phone subbands and the Novice 10 meter phone subband. For parchment certificate, send QSL card, contact no., and a 9 x 12 SASE to *Micky Corrow N1JIF, RR2 Box 48, Bennington VT 05201-9537.*

AUG 14-18

ST. PAUL ISLAND, NOVA SCOTIA Members of the West Island ARC of Montreal are planning an expedition to St. Paul Island, and plan to operate Station *CY9CWI* in CW, SSB, and RTTY. Operations begin at 0000Z Aug 14 and will continue through Aug 18. Times are tentative. Frequencies: CW (MHz) 1.835, 3.505, 7.040, 10.120, 14.035, 18.105, 21.040, 21.120, 28.050; SSB (MHz) 1.840, 3.780, 7.205, 14.195, 18.130, 21.295, 24.490, 28.395; RTTY (MHz) 3.590, 7.040, 14.090, 21.090, 28.090. Address QSLs to the *West Island ARC, Inc., P.O. Box 884, Pointe-Claire/Dorval, QC H9R 4Z6, Canada.* Address inquiries to *Fred Archibald VE2SEI*, 130 Embleton Crescent, Pointe Claire QC. H9R 3N2 Canada.

AUG 14-22

KNOX, PA Knox-area hams will operate *KE3CN*, *N3IOP*, *W3MBD*, and *KA3WJJ*, to commemorate the annual "Horse Thief Days Festival." Operation will be in the 40, 20, 17, and 15 meter bands, and 28.350 Novice. For a certificate, send QSL and SASE to *Gloria Barlett N3IOP, Box 12, Knox PA 16232.*

AUG 18-25

CALGARY, ALBERTA, CANADA The Calgary ARA will operate Station *CH8MNP* from Cameron Island (100 Kms from Magnetic North Pole) on 160-6 meters, all bands. Frequencies: 28460, 28560, 14260, 21260, 7060, 3760; CW, 5 up from bottom edge of bands. QSL to *CARA, Box 592 Stn. M, Calgary Alberta T2E 5J6, Canada.* Please include IRC, Canada postage stamps or equivalent.

AUG 20-22

SOCORRO, NM The National Radio Astronomy Observatory ARC will operate Station *NA5N* for the dedication of NRAO's Very Long Baseline Array (VLBA), a continent-wide system of radio telescopes that will be the world's largest dedicated astronomical instrument. *NA5N* will operate from 1800Z Aug. 20-0200Z Aug. 21; and from 1800Z Aug 21-0200Z Aug 22, on 80, 40, 20, 15 or 10 meters, depending on propagation, in the lower portions of the General-class phone and CW segments. A special net including amateurs from the VLBA antenna sites and other NRAO observatories will be held at 1800Z Aug. 21st on 14.250 MHz. For QSL, send QSL and SASE to *NRAO ARC, P.O. Box O, Socorro NM 87801.*

AUG 21

FRANKFORT, NY Members of the Fort Herkimer ARC will operate *AA2AT* 1200Z-1800Z at the fairgrounds, in conjunction with the Herkimer County Fair. Operation will be on 10 meters Novice phone, lower portion of 15 meters Novice CW, and the lower portion of 15 and 20 meters General phone, per band condi-

tions. For a certificate, send QSL and SASE to *FHARC, c/o Madeline M. Loiacono AA2AT, 342 Fourth Ave., Frankfort NY 13340.*

AUG 21-22

SAN RAFAEL, CA The Marin ARC, Inc. will operate *W6SG* 1000-1600 hrs. (PDT), from the clubhouse locations at Hamilton AFB and the San Rafael Red Cross, to commemorate the 60th Anniversary of the club. Operation will be on all bands, all modes, including the Novice subbands. Look for *W6SG* at the lower portion of each subband. For a certificate, send QSL and SASE to *MARC, P.O. Box 151231, San Rafael CA 94915-1231.*

VANCOUVER, WA Station *W7AIA* will be operated by the Clark County ARC to help the Northwest Antique Aircraft Club to celebrate the 34th annual Fly-In at Evergreen flying field, just East of Vancouver. Operation will be in the lower portion of the General phone bands; 40, 20, 15, with possible operation in the 10 meter novice band, and 75 meter band at night. For a certificate, SASE to *CCARC, P.O. Box 1424, Vancouver WA 98668.*

AUG 21-23

ENGLEWOOD, NJ The Englewood ARA, Inc. invites all amateurs the world over to take part in the 34th Annual New Jersey QSO Party. The contest is from 2000 UTC Aug. 21-0700 UTC Aug 22; and from 1300 UTC Aug. 22-0200 UTC Aug. 23. Get details from *Englewood ARA, Inc., P.O. Box 528, Englewood NJ 07631-0528.*

AUG 27-SEP 6

N. SYRACUSE, NY The Liverpool Amateur Rptr. Club will sponsor a Special Event Station at the 1993 New York State Fair. A Morse code "test" for children will also be available, with a certificate earned for sending their name. Operation will be from 10 AM-9 PM each day, on Packet, HF, and VHF, in the bottom 25 kHz of the General phone and CW portions of 80, 40, 20, 15, and 10 meters. The station will be located in a 1910 Caboose owned by the CNY chapter of the Nat'l. Historical Railway Soc. Certificates will be sent for all contacts.

SEP 1-6

MT PLEASANT, IA The Mt. Pleasant IA ARC will operate *W0MME* at the Midwest Old Threshers Reunion. Frequencies: 3970 kHz, 7243 kHz, 14271 kHz, 147.39 (+600) and 444.950 (+5 MHz) Rptrs. For QSL, send SASE to *Dave Schneider WD0ENR, RR3, Box 307A, Mt. Pleasant IA 52641.*

SEP 4

PANAMA CITY, PANAMA The Radio Club de Panama will host "CQ Contest Anniversary Radio Club of Panama" between 00:01 and 23:59 GMT, on 40, 20, and 15 meters, to celebrate the 22nd Anniversary of the founding of the club. For details, contact *Radio Club de Panama, Anniversary Contest, P.O. Box 10745, Panama 4, Panama.* Fax: (507) 26-4477. Packet: *HP1COO@HP1XNE.#PANC-TY.PAN.SA*

SEP 5-6

AUBURN, IN The North East Indiana ARC will operate *N9JHF* 1400Z-2100Z Sep. 5 and 6, to honor the Auburn-Cordusenberg days. Operation will be in the lower 25 kHz of the General phone and CW bands, 40-10 meters. For QSL, send QSL and SASE to *NEIRC/ACD, P.O. Box 745, Auburn IN 46706.*

NEVER SAY DIE

Continued from page 4

mainly made equipment for the military.

I'd just started 73, so this bomb almost put my fledgling magazine out of business. Worse, the ARRL proposed rule change also discouraged school radio clubs and almost 100% of them folded up.

That's when we lost our infrastructure... our main source of new hams. Up until that time 80% of our new hams had been teenagers, according to an ARRL study. Fifty percent of the newcomers were either 14 or 15 years old. Further, the study also showed that 80% of these newcomers went on to high-tech careers as a result of their interest in amateur radio. Thus, once we lost our source of new hams, our communications and electronics industries lost their major source of recruits. I don't know how much this contributed to our loss of consumer electronics industries to Japan, but there's no way this could have made things better for us.

So here we are in 1993. I'm not really sure what good reason there is for our hobby in today's world and as we are running it. We have little need for the Morse code any longer. We have little need for much in the way of electronics education since we are building little and repairing not. Thus, if our exams are going to be relevant to what we're actually doing, what kind of questions should be asked?

We do want ops to know the rules, even if many ignore or flaunt them. And we'd like them to know how to be good operators, even if their personal crazy-

ness keeps them from doing this. It would be nice if they had a concept of how our bands are laid out and how each one works. Perhaps we should ask that they have an understanding of how the various modes work... what FM and AM mean. How SSB works. How RTTY and SSTV work. How packet works. How to make satellite contacts. How repeaters work. Things like that. It could be helpful if they had an understanding of antennas and how to tune them. They might burn out fewer finals. And how about knowing how to tune receivers? And how to keep from turning up their compression control and messing up the band?

I wonder if we might be able to include at least a basic course on how to talk, something that has been sadly needed for years? We've got rag-chewers who've been saying the same stupid things for years, without one ounce of brains showing through. Their rag is so thoroughly chewed it's about dissolved.

The code. Yes, I know we need some sort of filter to keep the good guys out and let in as many crazies as we can. The code has served this purpose admirably for decades. I see where an Extra Class licensee just had his ticket pulled for transmitting false distress signals. Two other Extra Classers were put in prison for bad language on CB. Another took a gun and shot his co-workers. Great filter we've been using. The only fairly sane Extra Class licensees I know cheated to get their tickets using the Bash system.

Yes, I know all about the ITU requiring a knowledge of the code for operation under 30 MHz. I also know that the ITU

does not specify any speed, so we could just as easily let 5 wpm be the only code speed we check for all classes of license. The nice thing about 5 wpm is that you don't even have to be able to copy the code to pass a test at that speed. You can just write down the dots and dashes and then decipher them at your leisure. It doesn't take much effort to at least learn the code characters. I did it one night when I was 12 and was getting dressed to go to a Boy Scout meeting. Took maybe a half hour, tops, and I've known 'em ever since.

It doesn't take long to memorize stuff like that. I had to memorize the Greek alphabet during a fraternity initiation. That took maybe 10 minutes and I've known it ever since. Now and then it comes in handy. Handier than the code ever has.

The Up and Down Sides

What would be the benefit of going to one class of license? Well, it would save a lot of money and a lot of aggravation. It would also result in our having a lot more hams. And that, in turn, would result in our having more political clout.

Oh, my God, think how crowded the bands would get! Maybe. On the other hand, we need some pressure to get us to use the 99.9% of our allocated bands which we are flat out not using yet. We also need some kind of pressure to get us to invent and pioneer some more spectrum-efficient modes of communication.

Oh, we moan and groan about 450 MHz being packed solid. Baloney. It's packed solid with little-used repeater links which could just as easily be moved to 10.5 GHz, where hundreds of them

could all share one single frequency, using directional antennas to prevent interference.

We're busy fighting each other for DX, creating pile-ups and worldwide bad feelings. Some fairly simple digital techniques could resolve this mess in a hurry. For that matter, once we go digital, we'll be able to have our stations make DX contacts for us automatically in about a second and we'd be able to work all 400 countries in one day. This might even make it so those of us who have learned to talk might be able to enjoy actually talking with chaps in rare spots around the world.

I can hear the croaking chorus of old-timers now. If we open the gates our ham bands will be as bad as the Citizen's Band. Only hams who have (a) not listened to our bands in several years and (b) not listened to CB in years could say such a dumb thing.

Of course I don't think I've proposed making the ham ticket as easy to get as buying a CB rig, so I doubt we're going to be attracting very many Southern truck drivers. But then here you are arguing with me about how bad this would be and you haven't asked me what I'm proposing in the way of a license test barrier.

I know it's unpolitic to even suggest that there are classes of people in America. Well, Vance Packard many years ago described different classes and did a good job of it. We do have different classes and they stay fairly separate. In fact, they are less flexible these days than they used to be a generation or two ago. It used to be much easier to move up in class.

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The classes are divided by language, kinds of homes, the clothes they wear, the clubs they belong to, the kinds of cars they drive, their furniture, the foods they eat, and so on. Hams, as I mentioned, tend to center on lower middle class, with almost no lower class people attracted to the hobby, and only a few of the upper middle class. We have a few doctors, lawyers, and business executives, but very few of these are particularly high-earners. Hams tend to center in the \$35,000 to \$65,000 family income range.

The positive side of this sociological excursion is that, being of a similar class, hams tend to be able to get along with each other easily. It results in our ability to talk about things of common interest during our contacts. We tend to have common backgrounds. If you've ever attended a major hamfest or convention you can see this... particularly when you compare the mix of people with a CB convention. Different group of people entirely. So it's no wonder hams tend to look down on CBers. We haven't completely eradicated class consciousness in America yet.

Taking all that into consideration we have a little problem for you to talk about and come up with some ideas. If we're going to continue to have a government franchised and supported hobby for middle-class white men we've got to find a way to justify our use of billions of dollars in public resources. We've got to come up with some solid reasons why the rich and the poor, and the other 99.5% of the middle-class, should fund our fun.

Please advise.

Wayne Hates CW!

Our CW religious fundamentalists will accuse me of hating CW. I don't hate it. I don't love it either. Do I have any other choices? Yes, I'm opposed to using a code test to keep people out of the hobby. We don't demand a typing test for new hams so we know they'll be adept at RTTY and packet and not have to sit there staring at their keyboard, trying to find the letter they want. We don't even ask newcomers to pass a spelling test.

CW is a fun mode and should be kept that. Those of us who enjoy batting out our conversations with a key should do it because it's fun. Instead we've made the code the biggest ogre keeping people out of the hobby. That's one way to make absolutely sure that few newcomers enjoy the code.

When I first started going to hamfests they all had code copying contests, complete with certificates. I'll always remember W2ECL, the local code champ, winning the contest at the Hudson Division Convention in 1938. He slaughtered 'em. I'll bet we can make it a matter of pride to be good at code by running competitions at hamfests and conventions.

One-Class License!

Other than giving up your ability to be overbearing toward those lower license classes, what have you against opening all of our bands to all classes of license?

What I'd like to see is a license issued by ham clubs to members who've demonstrated their knowledge of our rules, who have an understanding of

the various modes available to us, and who have shown they know how to operate. You want to be a ham? Join a club and get some training.

Just as important would be the right of the club to take the license away if the member they endorsed does bad things. We make it far too difficult to de-license our crazies. A ham license is not a right, it's a privilege, and it should be able to be taken away as easily as it's given. Make sense?

I'd rather see clubs handling these problems instead of lawyers and the courts.

CW Again

I got a letter from a nervous nelly who was afraid of appearing in print. It said, "I wish you'd quit picking on all us old CW operators! I've been a ham since I was 15 and still love CW and work it 90% of the time. My time on the air is half rag-chewing and half DXing, mostly on a band you don't like, 30 meters." My answer: Dear Nervous, as far as CW is concerned, I'll be even more supportive of it when you stop insisting on jamming it down everyone's throat just because you enjoy it. CW is a fun aspect of the hobby and should not be used as a weapon to keep out 90% of the kids we might attract out of the hobby. CW is fun, but it's like playing with antique cars in that it's a hundred-year-old technology and it's pathetically outdated.

Japan Has 1.3 Million Hams!

Not bad for a country with half our population. Now, if you think the ham bands are crowded here in America,

wait'll you get anywhere near Japan! It's no wonder that they are leading the world in UHF pioneering. It's really amazing to look through the Japanese *CQ Ham Radio* and see all the fantastic experimenting and building they are doing. That's probably one of the reasons their electronics parts business is still going strong, while ours is long-gone unless you hit that mother of all junk piles, the Dayton Hamvention flea market.

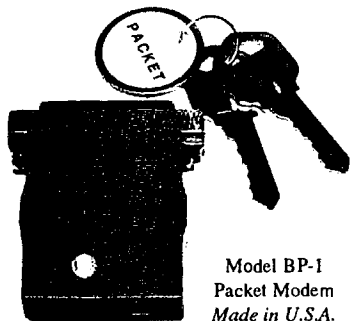
When you visit Tokyo, if you're a ham you'll be heading for the fabled Akihabara section of town, where endless small shops are teeming with youngsters shopping for parts. It's even better than the old Cortlandt Street (NYC) shops, where I spent much of my youth... and my allowance.

Japan is going bananas over mobile radios. They had 5 million transmitters licensed in 1989, and have been increasing about a million a year since then.

The World Direction Finding Championship

185 hams from 23 countries gathered in Siofok, Hungary, last September to participate in the 6th World ARDF Championship contest. No, no one was there from the U.S. They did have participants from all over Europe and even from Japan, China, and Mongolia! It's pretty sorry that we Americans couldn't even field one crummy team for a world championship ham contest like that. I guess our clubs are too busy with business meetings to promote amateur radio as a sport.

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Let me start from the beginning and show you how this whole concept developed. It all had to do with the increasing pleas for the U.S. to support the disintegrating situation in Russia. Being a conservative and an entrepreneur, I'm a natural enemy of socialism and communism, so I'm not a big fan of giving money away. I'm in favor of the "teaching 'em how to fish" approach.

Financing Russia

Russia, to no one's surprise, is in one hell of a mess. Yes, it's a self-brought-on mess, so we're not terribly inclined to ante up now that they're passing the hat. Just look at the misery and expense the USSR caused the world over the last 50 years!

So here we are at a time when our Congress has already borrowed to the hilt to pay off lobbyists' demands for pork and entitlements. It's a really terrible time to see Yeltsin, tin cup in hand, begging to feed his starving family.

Russia, and the other ex-Soviet republics, are in awful shape. They haven't the infrastructure, the legal system, the banking system, or even a political system to help them cope with what's happening. Worse, the mess in Yugoslavia could well be just the beginning of a whole series of tribal wars.

I had an opportunity to go over to Russia and The Ukraine last year with a University of Virginia group to help teach them more about capitalism and entrepreneurialism. But without roads, communications, power, a business-oriented legal system, food distribution, and so on, I didn't see how I could really help much. The team, on their return, confirmed my suspicions.

Well, you've got plenty of sources for in-depth recitals of the problems facing the Soviet Republics. I've found *Foreign Affairs* particularly helpful, plus articles in *Forbes*, *Fortune*, the news magazines, and *The Public Interest*.

Yes, I've visited Russia. And the Ukraine.

Since the collapse of the USSR we're the only world superpower, which has for some reason been translated in many minds into America being responsible for solving all of the problems of the world. Not just those which pose threats to us, but those which pose threats to anyone. Methinks I detect another liberal agenda . . . another "let's tax everyone and spend the money to do a social good." And never mind that the recipients will probably end up hating us for it. We've never had much success with buying friendship.

Buying Things Instead of Friendship

A few years ago there was a call by the Russian ambassador for proposed

solutions to the problems facing the USSR as communism collapsed and they were facing massive changes. I remember sending a letter with my proposal for solving their problems. I felt that the single most critical need for all the new republics was a stable currency. Russia, for instance, needed to make the ruble convertible. To do that they needed to back it with something which had acknowledged value. They'd already plundered much of their gold hoard, so there wasn't nearly enough gold left to back their currency. Worse, to meet the demands for military, bureaucratic, and state-owned business payrolls, the printing presses were cranking out tons of ever more worthless rubles.

I pointed out that the Soviet republics did have one very solid asset which could be used to back their currencies. The governments own almost everything . . . the land, homes, factories, the railroads, and so on. If the ruble, for instance, could be backed by the real value of these assets, it could become convertible. The value pledged would have to be internationally accepted for it to work.

Thus, if the government of a republic wanted to keep the ruble presses running, they'd have to pledge more and more of their assets to back the new notes. This eventually would have a chilling effect on the normal bureaucratic tendency to ignore inflation.

This would set the stage to make it possible for foreign aid to be sent in exchange for assets instead of mere gifts . . . loans, they're called. I know I'd feel a lot better about American loans to foreign countries if I knew we were getting something of value in return . . . something more than hate. At least then, when we pour more billions into the Swiss bank accounts of third world tyrants, we'd end up owning something.

But what about that inflation business? If we "buy" land at \$50 an acre in return for lending money to a tyrant, what happens when the value of the land drops to \$5 an acre? Unk screwed again? Nope, if we get good value for our "loans" we could care less how badly they inflate their currency. The property we get in exchange will hold its value.

So Why Can't They Just Take It Back?

The assets they're exchanging for "loans" will only be recoverable if they repay the loans . . . plus interest and the value of any improvements we've made, and with inflation factored in. What I have in mind is the actual ownership of any real estate or other property by the United States or any other loaning country, for that matter. This property would be ceded to us and thus be a part of America and not be subject to their laws or expropriation. Yes, this is a tough bargain, but if they want to borrow money we need to have some real security to guarantee its return (with interest), or something of real value in exchange. And none of this 99-year lease business which has come to haunt Britain in Hong Kong.

We sure could use some land for American military and business outposts in the countries we have been giving billions of dollars to. We'd also have to be granted access via air, sea, and land to our enclaves. Make sense? And each of these enclaves would obviously count as a new country.

The alternative of not getting out

money is always there for the countries to choose.

Again, my perspective is from that of capitalism instead of socialism. The socialist impulse, which is so strong at times, is to take from the rich and give to the poor. Never mind why the people you're taking it from are rich or why the people you're giving it to are poor. Never mind that the poor spurned education, while the rich worked their asses off to be educated and then to be successful in their work.

It turns out that there are very few well-educated poor (other than teachers), and few uneducated rich. Teachers and bureaucrats, who tend to think in socialist terms, with disappointingly few exceptions, have their own self-made hell.

The capitalist approach is a quid-pro-quo. If you want money from me, what'll you give me for it? This approach could put a whole new spin on our incredibly generous loans to the socialist country of Israel. And don't you wish we'd ended up with more than a fleeting sneer of gratitude for our investment in Kuwait? As I've pointed out in the past, gratitude is one of the least felt and most transient of all human emotions. Isn't there a platitude about never lending money to friends? Well, it turns out that we never seem to.

I'd love to see an American enclave in Jordan in return for the billions we poured into that country. Hell, we'd own most of the south end of Israel by now if we'd bargained, and we'd be able to build our own settlements. We might even be able to open some schools and educate the Palestinian kids to beyond the rock-throwing stage of human development. On the other hand, we could have exported our dreadful public school system and made their situation even worse.

It's too late in the century to call this 20th century imperialism. We might call it 21st century capitalism. Just look at the success of Hong Kong, which is a good example of what I have in mind. And look at the mess they're in now that the colony is about to be returned to China. Another good example is Singapore. And Macau.

If we'd thought of this approach a few years ago we could by now own both Aqaba (Jordan) and Eilat (Israel), and have a prospering capitalist enclave on the Arabian Sea. This would have come in very handy when we wanted to cut Saddam off from the flood of food and munitions being imported through Aqaba and trucked to Iraq. I've personally seen the endless truck convoys involved in that operation.

And instead of just flat out giving aims to Egypt we could have expanded the Aqaba-Eilat enclave on down the Sinai Peninsula, making another Hong Kong or Singapore type of settlement.

So what have we now to show for the billions we've poured into Africa, Asia and the Middle East? Bupkis. All we've got is a bunch of people who owe us far beyond anything repayable, and who hate our guts. Am I exaggerating?

The next time Congress or the President get the itch to give away money let's try to talk them into getting something of value in return. Let's get them to think of investing instead of giving. This isn't a bad concept here at home the next time our liberals want to throw money at social problems. Let's consider how we can get something in exchange.

For instance, I've recommended that kids borrow money (with interest) to pay for their educations . . . starting from at least the first grade. They'll be a lot more careful in how they invest it and not be as likely to fritter their investment away. The same goes for unemployment payments and welfare. Instead of taking the money away from us in payroll deductions before we're unemployed, making us all feel as though this money is coming to us, suppose we made the payments as loans to the unemployed which would then have to be repaid from future earnings? Once repaid, the money would no longer be deducted from their paychecks.

But what about deadbeats? Their checks could start getting smaller when their total payments got out over a certain percentage of their most recent annual salary. Beyond that they'd have to report for work and do something. This crew could help keep streets clean, help in hospitals and nursing homes, and so on. We're not short of jobs that need doing that don't take a lot of education or experience.

You probably share the same feeling I do. When I eat out I'm paying for that roll and butter, so I eat it . . . even if I'm dieting and would never eat it at home. It's difficult to turn down something that you've paid for because it seems like it is free.

Hmmm, I seem to be getting off on a sidetrack again. But a good one. If Congress would insist on getting something of value in return for foreign loans there would be fewer of them and we'd at least end up with something in exchange for the taxes the IRS takes from us at gunpoint. We might even be able to make good money with our investments in overseas enclaves and thus eventually be able to cut our taxes.

No, I'm not promoting 21st century imperialism. It's capitalism. Mercantilism. I don't see why any enclaves we get in exchange for loans would have to be run from Washington. They would not be conquered territory. They'd be bought and paid for. And, as we add value to the territories, their buying back would be more expensive for the selling country . . . which would be built into our purchase agreement. We don't need to see our investments expropriated by new tyrant-run or socialist governments.

Britain had similar arrangements with Hong Kong, Sarawak, Brunei, Sabah, Australia, and other countries . . . all of which I've visited . . . so I've seen firsthand how well this protective umbrella has worked.

So let's get busy and let our Congress know we're opposed to the old style of foreign aid giveaways. Let's stop just giving and making enemies. Let's use our help as a way to spread capitalism. That will, in turn, tend to spread democracy.

If Russia is in desperate need of a bailout, and if we really can afford to go deeper in debt to help them, let's find out what we can get in return. Someplace where we can start sewing capitalist seeds in an enclave that used to be Russian. How about a couple thousand or so acres up around Yvborg, on the Baltic Sea, not far from Helsinki and St. Petersburg? That would be a great spot for a capitalist enclave, and it would tend to help the Russians in their conversion to capitalism. I'll start packing a rig to put it on the air.

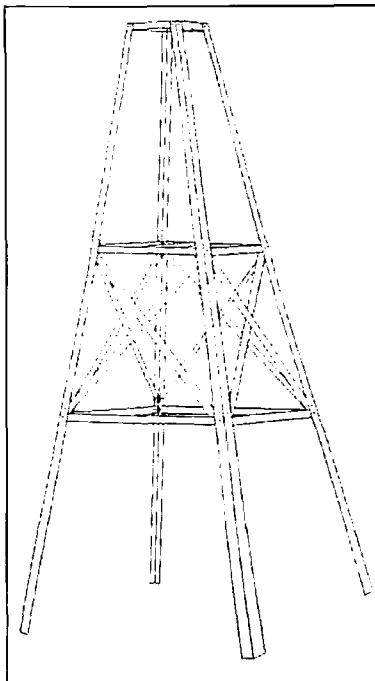
Now, what other countries are in that line for U.S. handouts?

NEW PRODUCTS

Number 27 on your Feedback card

Compiled by Charles Warrington WA1RZW

GLEN MARTIN ENGINEERING



Glen Martin Engineering has announced the addition of two new roof towers to its aluminum antenna support line. The premier model is the RT-936, a 9-foot four-leg tower capable of mounting up to 28 square feet of wind load. This tower weighs just 78 pounds and the price is \$378.75.

The lighter model is the RT-832, weighing only 37 pounds. This four-leg tower stands 8 feet tall, and will support wind loads of up to eight square feet. This tower is priced at \$189.95.

Both towers are UPS shippable. Both come complete with rotator mounting supports and a top plate stamped for direct thrust bearing bolt-up. The towers are constructed of rugged 6061-T6 angle aluminum with stainless steel hardware.

For more information, contact Glen Martin Engineering, Route 3, Box 322, Boonville MO 65233; (816) 882-2734, FAX (816) 882-7200. Or circle Reader Service No. 202.

ANTENNA SALES & ACCESSORIES

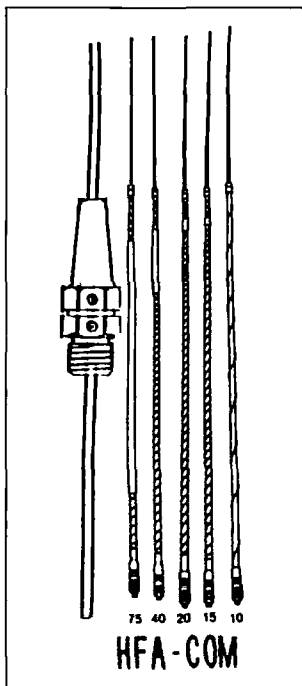
ASA has introduced a new HF mobile antenna package for the enthusiast: Model HFA-COM (High Frequency Antenna Combination). This package consists of five separate frequency "fiberwhips": 10, 15, 20, 40, and 75 meters. The unique design of these fiberwhips eliminates the need for retuning after each breakdown and set-up. The antenna is designed to withstand a heavy wind load with solid brass and chrome-plated hardware to handle the elements. The approximate assembled length is eight feet. It is priced at \$65, plus \$5. S & H. For more information contact ASA, P.O. Box 3461, Myrtle Beach SC 29578; (800) 722-2681. Or circle Reader Service No. 206.

AMATEUR NETWORKING SUPPLY

Amateur Networking Supply has introduced two new products designed especially for packet network builders: the Netrix Diode Matrix Board and the WireModem Adapter.

The Netrix is used to create a network switching node of up to six TNCs. The unique stacking configuration eliminates the need for cables, offers significant performance advantages such as higher speed and reliability, costs less than similar products, and is compatible with all TNCs.

The WireModem Adapter is an inex-



pensive yet reliable plug-in circuit that connects up to six TNCs together via their modem disconnect headers, using a passive WireLan matrix. Applications include connecting multiple network switching nodes together, hardwiring a data server into the network,

TEN-TEC

TEN-TEC has introduced a miniature HF transceiver priced at \$495. Simply plug in the desired band module and run SSB or CW on any ham band from 160 through 10 meters. Measuring only 2.5" x 7.25" x 9.75" and weighing five pounds, it is about half the size of many small HF transceivers. This 50 watt travel companion truly fits in a briefcase with room to spare. A patented Jones filter provides variable bandwidth 9-pole crystal filtering from 500 Hz to 2.5

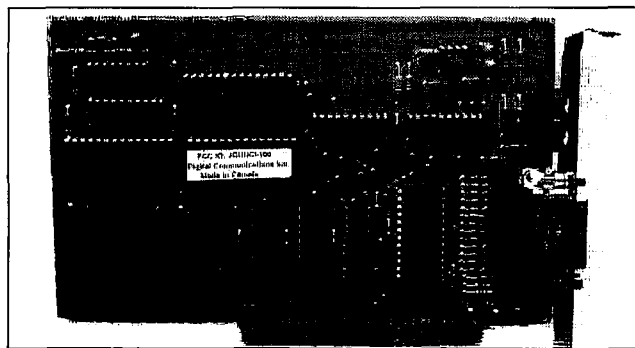
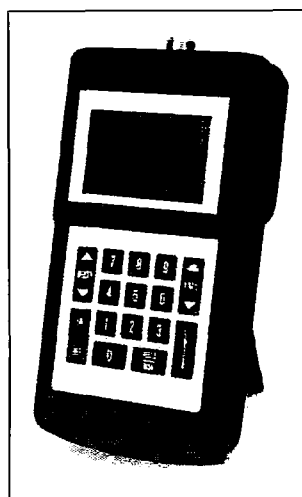


kHz. A built-in microprocessor keeps the VFO virtually drift-free and handles the built-in iambic keyer. For more information contact TEN-TEC, Inc., P.O. Box 8010, Sevierville TN 37864; (615) 453-7172, FAX (615) 428-4483. Or circle Reader Service No. 203.

ADVANCED ELECTRONIC APPLICATIONS

For antenna enthusiasts everywhere, the new AEA SWR-121 handheld antenna analyzer provides comprehensive antenna performance information in an easy-to-read graphic format. With its LCD spectrum display, the SWR-121 shows an antenna's SWR curve over an entire frequency range, unlike other instruments which can look at only one frequency at a time. This battery-operated unit is designed for portability and easy use.

For more information, contact Advanced Electronic Applications, Inc., P.O. Box C2160, 2006 196th St. SW, Lynnwood WA 98036; Sales: (206) 774-5554, literature request line: (800) 432-8873. Or circle Reader Service No. 201.



DIGITAL COMMUNICATIONS

DIGITAL Communications Inc. has introduced a new voice mail system for repeaters, consisting of the DCI-100 computer board and the DCI-MULTIM-BX multi-user mailbox software. The board plugs into your IBM PC or clone and connects to your radio or repeater. Individual messages are recorded by one user for replay by another. They are recorded on your hard disk in individual mailboxes for replay at a later time. The only limit on the number of

users or messages is the size of the hard disk. You can store roughly an hour's worth of messages for every 20 Mb of free disk space. The DCI-100 board is priced at \$199 and the DCI-MULTIMBX software is priced at \$60. For further information contact DIGITAL Communications Inc., 8946 Shook Road, R.R. #4, Mission, B.C., Canada V2V 5M2; (604) 820-1162, FAX (604) 826-0704. Or circle Reader Service No. 204.

or creating a gateway between different network types. The WireModem can operate at 19,200 baud or more.

Both products are compatible with ROSE and TheNET networks. For

prices and more information contact Amateur Networking Supply, P.O. Box 219, Montvale NJ 07645; (201) 573-2717. Or circle Reader Service No. 205.

David Cassidy N1GPH

Not That Anybody Asked Me, But...

... We had a great time at the Dallas hamfest this past June. I'll take Dallas over Dayton any day.

... Now that the Novice license testing falls under the VE program, how long do you think it will take for the Novice license to go the way of the dinosaur? Also, how many hundreds of youngsters living in non-urban areas will say "ah, screw it" when they find out they have to convince Mom or Dad to drive them a hundred miles or more for a license test?

... Why do volunteer examiners get to charge a fee? I thought this was a hobby. Let's see, if you have 25 people show up for an exam session, and they each give you five bucks, you'd walk home with a little over \$40 in your pocket (assuming that you split the total among the three VEs). Not bad for an hour's work.

... I hear that the new software being installed at the FCC licensing facility in Gettysburg has provisions for assigning special call signs for a fee. I hope Congress lets the FCC keep the money they collect for issuing custom call signs.

... Our sister publication, *Radio Fun*, achieved something unheard of in the publishing world. A "renewal percentage" is the number of renewals a magazine gets every month, compared to the number of people whose subscriptions expire in that month. Anything over 70% is considered excellent (73 consistently has a renewal percentage of around 80%). In February, *Radio Fun* had approximately 3500 expirations, and only 3 subscribers didn't renew. That's close enough to call it a renewal percentage of 100%. It's gratifying to know how much the readers of *Radio Fun* love their magazine.

... We had a nice 6 meter opening on the East Coast last week. From my shack in New Hampshire (using an antenna cut for 10 meters), I heard stations in Virginia and South Carolina. I was on the phone with Gordon West yesterday (he lives on the West Coast) and while we were chatting his 2 meter radio started receiving the beacon from Hawaii. Ah, doncha' just love summer band conditions!

... Why is it so difficult to get people to have a real conversation on the ham bands? We have got to stop this "three-minute monologue then give your call sign" type of QSO. You don't do that with your buddies on the local repeater, so why do we all turn into Edward R. Murrow when we get on HF?

... I've got my 20 meter portable QRP station all set for my summer camping trips.

... Could you guys on 20 meter CW slow down a little? I haven't worked a whole lot of CW lately, and I'm a little rusty.

... Does anyone out there know how to keep deer from eating your tomatoes? Last year, I started about 30 tomato plants from seed, in my kitchen window, in the middle of February. I babied those little plants and had enough plum tomatoes ripening by August to last us all winter (if you've never made tomato sauce with fresh garden tomatoes, you don't know what you're missing). I didn't think the deer would eat tomatoes. Boy, was I wrong! I went away to the National Convention last year, and when I got back, there wasn't a single tomato left.

I've got three dozen tomato plants of

several different varieties growing in my garden this year, and short of building a fence, I can't think of anything that will keep the vermin from dining on the fruits of my labor. Send your gardening tips to me, c/o 73.

... Could you guys on 20 meter CW please slow down just a little bit more? I'm rustier than I thought.

... Would anyone out there like to trade some ham gear for an ultralight vehicle or small plane? Send your inquiries to "The Poor Pilot", c/o 73.

... Speaking of aviation, if you're into flying and are at all interested in the areas of experimental, homebuilts, kilplanes or ultralights, you really ought to be reading *Kilplanes* magazine. The publication is extremely well done, and the head honcho is a ham!

... Why do some of you insist on sending mail to my home address? If you want to respond to me in my capacity of Associate Publisher of this magazine, please write to me at the magazine. It really irks me when I get business mail at home (and I never answer it).

... President Clinton still hasn't found anyone to head up the FCC. The woman he was rumored to have chosen has withdrawn herself from consideration, so as of this writing it's anybody's guess.

... As I'm writing this, President Clinton is having a chat with shuttle astronauts. He just mentioned the SAREX program! Hey, maybe we should get Chelsea's school signed up for the next SAREX mission. Just think of the positive publicity for amateur radio.

... I'd like to get into ATV.

... Speaking of ATV, I hear that there is a move afoot to change the rules so ATVs could broadcast music as part of an ATV transmission. I'm not so sure this is a good idea. What do you think?

... Ummm, you guys on 20 meter CW—just a little slower and I think I'll be all set.

... Have you checked out America On-Line yet? If you're using Prodigy, you'll be amazed at how fast a real online service can be. AOL doesn't mind "for sale" messages, doesn't censor like Prodigy does, doesn't force you to read ads, doesn't charge extra for downloading software, allows you access to Internet e-mail, and it has live conference areas, so you can communicate in real time with a whole bunch of people about any topic under the sun. There's a great ham radio area, too. My AOL address is "D Cass." If you check it out, send me a note.

... Watch for Wayne Green's re-entry into the computer publishing field—coming to a newsstand near you this summer.

... Wayne's other new magazine, *The Secret Guide To Music*, is growing like gangbusters! If you're a corporate music slave, you probably wouldn't be interested, but if you are the adventurous type and would like to find out about thousands of independent recordings, you really should check it out. They can be reached at the same address as 73.

... I love to run into 73 and *Radio Fun* readers on the air. Look for me on Saturday and Sunday mornings on the 40 and 17 meter bands (10 meters, too, when it's open). You can always send a message via packet to N1GPH@WA1WOK.NH.

... OK—you guys on 20 meter CW—just a little slower—please. 73

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Just when you thought the lousy July conditions were going to end, you find out the first days of August are probably going to be worse! However, from about the 5th through the 18th, it looks like conditions will be Fair or Fair to Good, with the better days from about the 14th to the 18th. Unfortunately, the days between the 19th and 24th are expected to be Poor or Very Poor, but improving slowly, so that the days between about the 25th and the 31st will be vastly improved, compared to the previous week.

I expect the ionosphere to be greatly disturbed and the earth's magnetic field to be at the major storm level sometime between the 20th and 23rd.

In general, August is a "blah" month for HF propagation, but normally conditions improve as September and the fall equinox approach. Bear in mind that we are now dealing with low to moderate solar activity as Cycle 22 rapidly nears its 11-year minimum.

10-12 Meters

There will be reasonable openings on north-south paths occasionally during the afternoon hours. Sometimes there will be F2 openings to Pacific spots and rare ones to Europe early in the day during the days marked Good on your chart. Short skip 1,300-2,300 miles.

15-17 Meters

Regular DX openings are expected on days marked Good and are expected in the Southern Hemisphere during daytime hours, especially in the afternoon. Expect occasional openings on east-west paths to Europe or Africa on days marked Fair to Good, with rare excellent conditions to all parts of the world on a few days. Short skip 1,000-2,000 miles.

20 Meters

This is probably your best bet for worldwide DX on Good days, with the band opening from sunrise to a bit after sunset locally. Early mornings and late afternoons provide peak conditions. Short skip will range from about 750 miles to 2,000 miles frequently.

30-40 Meters

On Good days, expect openings from after dark to local sunrise to most parts of the world. Expect daylight short skip from 100 miles to 1,000 miles and beyond 1,000 miles after dark.

80-160 Meters

Openings will occur on some days during darkness hours and again around sunrise on Good days. Expect frequent trans-equatorial skip 100-1,000 miles during the day (if we're lucky) and beyond 1,000 miles after dark. Noise is abating from summertime levels. On 160 meters, conditions peak after midnight and again just before dawn. This is the best "night-owl" band for those who are able to take advantage of it. No openings are expected during the day, however, but during darkness hours, you'll work short skip out to 1,000 miles and more. 73

EASTERN UNITED STATES TO:

GMT	30	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	-	-	-	-	20	20	-	-	-	15
ARGENTINA	20	40	40	40	-	-	20	15	10	10	15	15
AUSTRALIA	15	20	20	-	40	40	40	-	-	20	20	15
CANAL ZONE	20	20	20	20	20	20	20	15	10	10	15	15
ENGLAND	40	40	40	40	-	-	20	15	10	15	20	20
HAWAII	15	20	-	-	-	-	20	20	20	10	10	15
INDIA	-	-	-	-	-	-	20	20	-	-	-	-
JAPAN	15	20	-	-	-	-	20	20	-	-	-	15
MEXICO	20	20	20	20	20	20	20	15	10	10	15	15
PHILIPPINES	-	-	-	-	-	-	20	20	-	-	-	-
PUERTO RICO	20	20	20	20	20	20	20	15	10	10	15	15
SOUTH AFRICA	20	40	-	-	-	-	20	10	10	10	15	20
U.S.S.R.	-	-	-	-	-	-	20	15	20	20	-	-
WEST COAST	15/20	20/40	40	40	160	160	160	-	-	10	10	15

CENTRAL UNITED STATES TO:

GMT	30	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	-	-	-	-	-	-	20	-	-	-	15
ARGENTINA	20	20	20	40	40	-	20	20	15	10	15	15
AUSTRALIA	15	20	20	-	-	-	40	-	-	-	15	10
CANAL ZONE	15	20	20	40	40	-	20	15	10	10	15	15
ENGLAND	40	40	40	-	-	-	20	15	10	15	20	40
HAWAII	15	20	-	40	40	40	40	20	20	15	10	15
INDIA	-	-	-	-	-	-	20	20	-	-	-	-
JAPAN	15	-	-	-	-	-	20	20	-	-	-	15
MEXICO	15	20	40	40	40	40	20	15	10	10	15	15
PHILIPPINES	15	20	-	-	-	-	20	20	-	-	-	15
PUERTO RICO	15	20	40	40	40	40	20	15	10	10	15	15
SOUTH AFRICA	20	40	-	-	-	-	20	10	10	10	15	20
U.S.S.R.	-	-	-	-	-	-	20	15	20	20	-	-
WEST COAST	15/20	20/40	40	40	160	160	160	-	-	10	10	15

WESTERN UNITED STATES TO:

GMT	30	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20	-	-	-	40	40	40	-	-	20
ARGENTINA	15	20	-	40	40	-	20	-	-	10	10	15
AUSTRALIA	10	15	20	20	-	-	40	40	20	20	15	15
CANAL ZONE	15	20	20	-	-	-	20	15	10	10	15	15
ENGLAND	20	40	40	-	-	-	20	15	10	15	20	40
HAWAII	10	15	20	40	40	40	40	20	20	15	10	15
INDIA	-	-	-	-	-	-	20	20	-	-	-	-
JAPAN	10	15	20	-	-	-	40	40	40	-	-	20
MEXICO	15	20	20	-	-	-	20	15	10	10	15	15
PHILIPPINES	10	15/20	15/20	-	-	-	40	40	40	-	-	20
PUERTO RICO	15	20	20	-	-	-	40	40	40	-	-	20
SOUTH AFRICA	20	20	-	-	-	-	20	10	10	10	15	15
U.S.S.R.	-	-	-	-	-	-	20	20	-	-	-	-
EAST COAST	15/20	20/40	40	40	160	160	160	-	-	10	10	15

73 Meters possible on good days only

AUGUST 1993

SUN	MON	TUE	WED	THU	FRI	SAT
1 VP-P	2 P	3 P-F	4 F	5 F	6 F	7 F-G
8 G	9 G-F	10 F	11 F	12 F-G	13 F-G	14 G
15 G	16 G	17 G	18 G-F	19 F-P	20 P-VP	21 VP
22 VP	23 VP-P	24 P-F	25 F-G	26 G	27 G	28 G-F
29 F	30 F-G	31 G-F				

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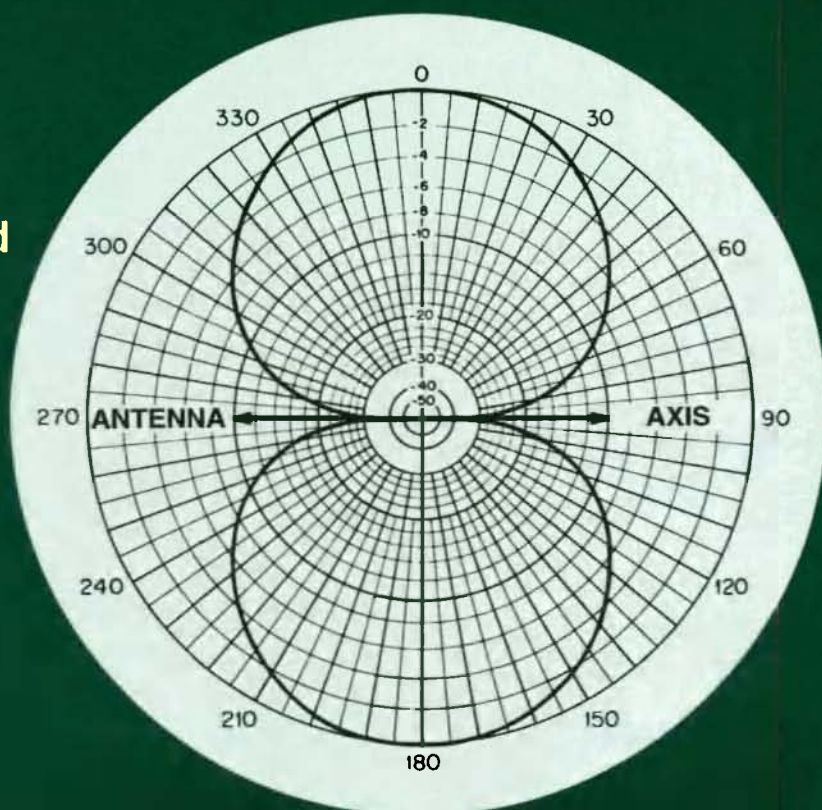
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Twisted Loop

Lazy H

Design a Discone

Recycled TV Beam



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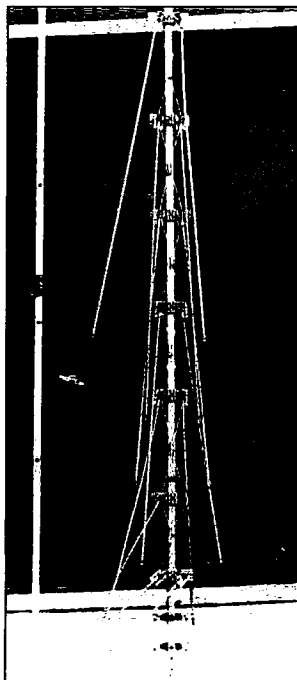
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.....WB9RRR



Turn this pile of junk into a 2
meter beam for \$2. See page 34.

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NEVER SAY DIE

Wayne Green W2NSD/1



Vox Pops

A letter from Richard KC4YQL got me to thinking. Now, you know that's gonna make trouble. And sure enough, trouble it is. But I think you're going to like it, if you're just a bit anti-establishmentarian. As an admitted proponent of disestablishmentarianism, I hope you go for it.

Richard made the usual mistake of coming up with a good idea and proposing it to the ARRL. Now you'll find no one more enthusiastic and supportive of the wonderful works being done by our esteemed League than your semi-humble servant. But, even in my unabashed admiration for the Newington Marvel, I do occasionally admit to some of the very slightest of misgivings about their bureaucracy and inertia, which in rare instances can give one the impression we're trying to deal with a federal agency. I'm always saddened when the true worshippers of our Radio Relayers blow my slightest of criticisms totally out of proportion, often subjecting me to outrageous vilification and slander. But that's in the same vein as Rushdie's problem with the equally religiously obsessed ayatollahs of Iran.

That aside, let's get down to brass tacks. No, I can't put that all aside yet. Sorry. But Richard's proposal has a lot to do with what a few malcontents perceive as a weakness on the part of the League. Heresy, of course, but these things have to be faced and resolved. It has to do with the false perception that the League's Board of Directors is far more involved with carrying messages from headquarters to the unwashed than in carrying the wishes of the unwashed to those high on Olympus . . . known locally as Newington.

Why not, begged Richard, let us lowly members comment on proposed rule changes before a firm position is taken before the FCC? Well, of course we old-time members know that we always have the right to write and express our opinions to HQ. Of course, I can't recall any instance, at least in the 50 or so years I've been a member, when these comments were taken into consideration. But that may be due to the admittedly faulty memory of a doddering old-timer who is gradually slipping into the pre-senility stage. That's what happens when one retires and

has too much time on one's hands.

But I happen to like the basic idea. In fact, why not take this one step further? Instead of coming up with good (and bad) ideas for rule changes and then dropping the ball . . . or far worse, sending them to the FCC . . . how about our starting a Vox Pops section in 73 where your proposals can be exposed for the brilliance or the stupidity they represent? We'd print 'em and the readers would then have an opportunity to congratulate you for your brilliance or vent their spleens over your incredible ignorance. The end result would be a reader poll. Those with enough support would be forwarded to the FCC for action and the rest would be given at least a decent burial.

Now, I know this whole concept is going to give the ARRL Board members fits. Only the League is supposed to interface with the FCC. All of us hams are supposed to first get the ARRL to agree with our proposals and then let them take it from there. Alas, the League's past record on reflecting the actual wishes of the members hasn't been exemplary, tending more to represent the interests of the Directors and those we've elevated via the Board to Olympus. I still vaguely remember the many years I fought the ARRL to get FSK permitted below 2m. They put up one hell of a battle, but they eventually lost.

The League, bless them, seems firmly rooted in the past. CW, that fascinating artifact from the 19th century, is obsessive. Many of us are eagerly awaiting a carbon dating report on test equipment discovered in the ARRL lab.

So, if you have some ideas for rule changes that you think are important, let's send them up for some flak from our inexhaustible supply of negative old-timers, who are against almost any changes, no matter how needed. If, after the smoke clears, the readers give a thumbs up vote, we'll submit your gem to the Commission and cross our collective fingers. How's that play for you?

So let's see some samples of your genius coming in to Vox Pops, 73 *Amateur Radio Today*, Peterborough NH 03458-1107. Maybe we can get this confounded hobby into usable shape yet.

Calling All Entrepreneurs

A note from Al Warsh N6UHF brought an article in the April *Mensa Bulletin* to my attention. It had to do with the need for a better avalanche beacon transmitter for skiers who get their jollies skiing in avalanche-prone areas. It seems that the current crop of such devices left enough to be desired so no one was able to locate a chap (or his body) who was in the wrong place at the wrong time last winter.

My advice is to take up downhill skiing and try to stay on the trails. This has been my approach and it's worked perfectly for me in 25 years of skiing. Yes, I know it's more expensive . . . unless you're my age and can ski free most places . . . but it is safer and more exciting. Oh, I tried cross-country skiing. Bor-ing. I haven't seen my cross-country skis, boots, and collection of waxes recently, so some past employee is probably enjoying them. Or has sold them.

If you're into experimenting, you might want to see what you can do. You want to find out what the current crop of beacons do, so you can do much better. I wish I'd saved some of the snow from last winter to help you experiment. We had plenty along in March. You need to find out what frequencies can get through about six feet of snow and for what range. Then you have to package the transmitter so it doesn't take a dog-sled to cart the power supply.

Once you have a nice small package and a manufacturing facility, if you don't have the money to finance the project you then have to find a venture capital outfit that will fleece you of everything in short order. They'll move the manufacturing to Taiwan, where copy-cat firms will clone the product, quickly putting the venture capital firm out of business. You'll end up with the comforting knowledge that it's your invention that's selling to millions of cross-country skiers through Eastern Mountain Sports and other ski outfitters.

While on the topic of entrepreneurialism, several readers of my book, *Declare War*, have mentioned that they've found it a gold mine of entrepreneurial ideas. Of course, I can't help coming up with more and more ideas for ways to make money. If you've bought the

book perhaps it's time to sit down and start reading it. But then you probably have your ear plugs screwed in tightly so as not to be annoyed by knocks on the door by Opportunity. Well, it's a lot easier to buy lottery tickets than to work, anyway. Unfortunately, the only number of yours that's likely to come up will be that one on your ARRL Silent Key certificate. I'm not sure if you have to be a member to get that award or not. Better join, just in case, right?

Gloom and Doom Revisited

Is technology about to eliminate the major excuse for amateur radio's existence? We've been buffeted by technological developments ever since WWII. First there was the transistor, a new-fangled contraption most old-timers never really quite got used to. And if that wasn't bad enough, then they began cramming parts on boards instead of on a chassis. Worse, then they shrunk the boards and transistors down to quarter-inch-square integrated circuits. By this time most hams had bailed out.

If we'd kept kids coming into the hobby we might have bridged the gap. Kids, not having been brought up on tubes, resistors, tuning capacitors and output transformers, were comfy with gates and phase-locked-loops. Alas, we zapped the kids in 1964 and they've never really come back.

So here we are in the '90s, with synthesized HTs and TNCs, and for most of us not a clue as to what's going on inside our predominantly black boxes. CW was replaced in the real world a generation ago by high-speed digital communications systems and facsimile. Now, when our rigs break, we don't get out a soldering iron, we get out the shipping box and call UPS.

No longer are we a technically educated resource for use in time of war. No longer are we inventing and pioneering new technologies as we did 50 years ago. We're not even doing much of value as good will ambassadors. Our one remaining claim to our billions of dollars in publicly-owned frequencies is our ability to provide emergency communications.

Some of our clubs are doing a fine job of this. They're outfitting emergency vans and have emergency-powered repeaters either in place or ready to set up. They're set to help different services intercommunicate. And they're able to provide short-, medium- and long-range communications by virtue of our many ham bands. Now, I admit it's true that most of our emergency communications systems are as slow as Gettysburg and prone to endless errors. Many of them are still rooted in the glorious 1930s, using CW and voice. But we do have a growing number of more modern systems using packet, digipeaters and networks. We have a few hams who are doing their best to set up these faster systems, despite endless interference from the officials of a national ham organization which I won't mention, for fear of being accused of trashing them, Iorsooth.

Continued on page 74

From the Hamshack

Rickey Nievera N2MBC, Carle Place NY Wayne, keep up the good work. I wonder if you will change the makeup of 73 Magazine to less kit building and more about ham radio operations, hints, kinks and the like? How about a "sermon" on how we can rebuild the "image" of hams: stopping the chaos on 20 meters, encouraging more activity in public service, volunteering in schools and in Boy Scout programs? Hams should be good citizens and not enemies of their neighborhoods because of TVI. Good neighbor relations should be stressed. Hams need to read more about preventing TVI, RFI, and telephone interference, and should ease up on power amplifiers during popular TV hours and on weekends. The rule is if you have a good contact (at least 5/7) there is no need to use a linear amplifier. Give the hams on low power a chance to get on the air. The guys with big console linears wipe the rest of us out. It's not fair! At least 80% of us use no more than 100 watts. The culprits are the Extra Class hams. Come on—let's get together and behave. Follow the rules and regulations. Let's have less bull-shit talk on the ham bands. No politics. Let's talk about technical items, computers and the like. Please—no politics over ham radio.

I have been a ham for over 25 years, as DU1EN, and now as N2MBC. I enjoy DX, not hearing about the country's problems and so forth. I usually hear some hams that I know from way back and we rag-chew about the old times. That is ham radio—friendship, learning about geography, etc., not too much foolish talk. Let's all enjoy this hobby—it is a great one—and not spoil it.

You're probably right, Rickey, We should not be discussing politics or religion over the air. As Arnold Glasgow said, "The fewer the facts, the stronger the opinion," so arguments about religion, where facts are nonexistent, are fruitless. And political arguments seem to seldom be based on any firmer ground, so let's avoid talking about the deficit, unemployment, welfare, racism, our lousy school system, crime, drugs, the recession, Congressional pork and bribes, Clinton, Rodham, Perot, and other such political matters. Why am I reminded of The Pirates of Penzance, where the chorus sings, "Let us compromise, (our hearts are not made of leather). Let us shut our eyes, and talk about the weather. Yes, yes, let's talk about the weather. How beautifully blue the sky, the glass is rising very high, continue fine I hope it may, and yet it rained but yesterday. Tomorrow it may pour

again (I hear the country wants some rain), yet people say, I know not why, that we shall have a warm July." . . . Wayne

Michael Graham, Baton Rouge LA I am writing in response to Jeff Carter KK6RY's letter (July 1993) as I await the arrival of my call sign from the FCC after having successfully completed the no-code Tech exam. I've read Carter's letter a number of times, becoming angrier each time. He seems to have some horrible need to feel superior to somebody, and has apparently directed his pseudo-superiority attitude toward the no-code Techs, who he feels will turn the 2 meter and 70 cm bands into some not-so-glorified channels resembling CB. Perhaps he has a poor concept of human nature. An exam demonstrating a degree of knowledge must be taken and passed. CBers just aren't going to do that. They haven't in the past, they don't now, and they're not likely to expend that energy in the future.

The no-code route into amateur radio was, I believe, designed to bring into the fold people like me—educated, reasonably intelligent, and who possess some knowledge of computers. I can't, of course, speak for all no-code Techs, but personally I'm already reading and learning, and eventually will achieve Extra Class. Carter's attitude toward us is the kind of elitism that cannot help but damage efforts to promote amateur radio.

I am angrier when Carter writes, "Let the no-coders run the local bicycle races and show off with their \$500 handie-talkies." Carter apparently has no use for public service. It's called giving something back. It's called serving your community. Baton Rouge just finished hosting the National Senior Olympics—successful in large measure due to the efforts of many amateur operators using a 2 meter repeater, their skills in communication, and a whole lot of their personal time.

I regret that Carter feels superior to me, and that I'm not good enough for him. If I run across his call on the air in the future, he'll not have to worry about wasting time communicating with me. I'll be too busy talking with people who care.

Clyde D. Nimal N8YBK, Columbus OH The letter by Jeff Carter in your July 1993 issue really burned me up. It is obvious to me that he doesn't know what he is talking about.

I have been licensed twice: once under the "old" system, where knowing the code was mandatory, and again under the new system.

While I felt that the old system was harder to work with, it did maintain a certain technical edge and launch many an electronics career, mine among them. I had little difficulty learning the code and eventually got a General Class ticket. But I remember well one poor chap who struggled mightily just to be able to tell the difference between a dit and a dah. For him, being tone deaf, this was a mountain to climb, not a hurdle to jump. To him, the present system would have been a godsend. I cannot help but wonder how many other potential hams we lost due to this one barrier.

It is equally obvious that because Mr. Carter has opted to not use VHF anymore, that he is missing out on a fact that makes his whole argument moot. There are quite a few of those "handie-talkie appliance operators" learning Morse code and upgrading. Every one of them has a no-code license, and one of them is hearing impaired! As one of the net control operators of the local CW practice net, I am well aware of the desire of these newcomers to upgrade and get on the HF bands.

Overall, I think that amateur radio will survive quite well with this new generation of hams, code or no code.

Steven L. Sanders N4WAK, Clearwater FL Wayne—I just finished reading your editorial in the June 1993 issue—sure am glad that I'm only an Advanced Class and not an Extra! You're always mentioning the 14,313 mess and I think that it is time to recognize another frequency as being possibly the second-worst for intentional interference . . . 14,230. I am an avid SSTV and am constantly amazed at the amount of amateurs who persist in using 14,230 as the national tune-up frequency, even when there are at least four or five stations actively talking or sending SSTV images that anyone with a piece of wire for an antenna would hear (if they listened first).

You also solicited comments from those of us who have purchased a new piece of equipment on what we have gone through getting it to operational condition. I have always leaned towards the purchase of ICOM gear, both for VHF/UHF and HF, and have recently purchased a new ICOM IC-W21AT dual-band handie. The radio is excellent and operates as well as the IC-W2A that it replaced. It takes awhile to learn all the bells and whistles even though it has an "AI" button for those of us who need some artificial intelligence.

I am very happy to see that companies like W & W Associates have come out with "universal" chargers that are capable of being fitted with a reasonably priced adapter so it can be used with a variety of radios. One of my major gripes over the last couple of years has been the ridiculous cost of a rapid charger for amateur handie-talkies. I mean, come on, get serious . . . you can buy a 9.6 volt

rechargeable drill with a battery pack and a quick charger for around \$50 at any hardware store, so why does an amateur charger have to cost so much? You always hear the old song and dance about how small the amateur community is versus any other consumer base and how they have to charge more, etc. I think they know that most people who buy an HT will also buy a rapid charger (for obvious reasons) and it's just their way of showing us how much they appreciate taking our hard-earned money.

I want to thank you for the articles you have published in the last year or so dealing with amateur slow-scan TV. The number of people on 14,230 and 14,233 using the SSTV mode has increased faster in the last year than in all of its previous years. Now, if we can just educate the rest of the amateurs out there and make them realize that we need a good 5 kHz of band above and below these two frequencies it would be great. We voluntarily constrain ourselves to operating SSTV and FAX modes on just these two frequencies on 20m and we could just as easily go anywhere and do it but we don't—we respect the rest of the ham population. Hopefully, we will soon be using advanced digital modes for transmitting images and possibly linking the sending and receiving stations and using error-correction, but right now it's more like RTTY than AMTOR.

Good luck and keep on fighting! I don't always agree with everything you say in your editorials but I never fail to come away thinking, "What if he's right?" Glad to see someone always taking shots at the ARRL, they need someone to snap at their heels and keep them (somewhat) in line!

Ed Campbell KD4SMQ, Macon GA As a new no-code ham, I subscribe to several magazines, including 73. When you asked for information on how we liked our new equipment, I thought I'd write with my experience.

Like many new hams, my first radio choice was an HT. Nothing gets you "on the air" as quickly or as cheaply. I purchased a Standard 168 and really love it. It is very well-built; I have even dropped it onto a concrete floor with no damage. At home I connect it to an attic antenna and power supply. I also use it with a mobile mag mount, but often I just carry it in the car with the rubber duck and hit the local repeater just fine.

I am working on the 5 wpm code to obtain my Tech Plus, but I must admit that it is not much fun and I often wonder, "What's the point?" Unless you can copy 13 wpm, there is little HF voice available to the new ham.

Question: With all the new no-code hams out there, why don't the manufacturers produce 6 meter rigs? a 2m/6m dual-band mobile would interest me.

Thank you for your magazine. How about some articles on 6m fun? **73**

Nervous Habit

The Associated Press reports the mystery of an electrician's lead poisoning was solved when the man revealed he enjoyed chewing bits of plastic coating he stripped off wires. A routine blood test indicated 48-year-old Elmer Galbraith, who lives near Johnstown, Ohio, suffered 10 times the normal lead level for humans.

Galbraith knew something was wrong when he sensed a tingling in his fingers and began suffering from memory loss and diminished math skills. The unusual case was documented in a government report which issued a warning about the hazards of chewing plastics which may contain lead. *TNX A.P./Scott Schram KN4L.*

Windy City Scanners Safe

Members of the Chicago Area Radio Monitoring Association are breathing a collective sigh of relief after waging a successful battle against the Chicago Scanner Bill. Jon Peterson N9OUM contacted this publication back in July when he found out members of the Chicago Board of Aldermen had proposed passing an ordinance which would have made owning a scanner a crime.

The names and addresses of these aldermen and details of their proposal spread like wildfire to computer bulletin boards across the country—including the 73 BBS. Jon reports that the response was impressive enough to cause the Chi-town leadership to do an about-face on the issue. The revised ordinance proposal punishes only those individuals who use scanners to commit crimes or interfere with police. A pat on the back for those who wrote letters. *TNX N9OUM/The Chicago Area Radio Monitoring Association.*

Mega-Telescope

The largest single integrated astronomical instrument in the world formally entered service on August 20, when the Very Long Baseline Array (VLBA) was dedicated at ceremonies in New Mexico. The continent-wide radio telescope system is the culmination of a half-century of development in radio astronomy.

The VLBA offers scientists the most detailed views of celestial objects available from any telescope on earth or in space. With 10 receiving stations distributed across 5,000 miles of US territory, its radio vision is sharp enough to read a newspaper in New York from the distance of Los Angeles.

To make images of astronomical objects, the VLBA uses ultra-sensitive radio receivers, superfast tape recorders, atomic clocks accurate to within one second in a million years,

and a high-performance computer that can perform 750 billion computations per second. The project is funded by the National Science Foundation. *TNX National Radio Astronomy Observatory.*

Quick Charger Extends Battery Life

A small Austrian company—*Enstore R&D GmbH in Graz*—has come along with a quick charging technology which not only does not harm batteries, but may actually extend their usable lifespan. A new chip is used to monitor the state of the battery's charge during the recharging process. Doing so allows the charger to feed the battery as much current as it can handle without causing heating or gassing.

The Enstore electrode-specific charging system (ECS) is touted as the solution for the dreaded memory effect suffered by NiCd batteries. Enstore claims the ECS can extend the useful life of a NiCd battery to 5,000 charge-discharge cycles from a typical average of 500 cycles. Application for the new technology is likely to spread from small hand-held electronic devices to electric cars. *TNX The Institute of Electrical and Electronics Engineers: The Institute Vol. 17, July/August, 1993.*

WACO Hams

At least two licensed amateur radio operators are now believed to be among those killed in the Branch Davidian Compound fire near Waco, Texas, on April 19. The FBI has identified Jeffrey C. Little and Douglas W. Martin as being among the followers of cult leader David Koresh who perished after the compound was set ablaze.

Koresh is believed to have set fire to the compound rather than surrender to the FBI after a prolonged armed standoff. Little AB5KZ and Martin AB5LA had both upgraded to Amateur Extra Class on February 23rd of this year. *TNX Westlink Report, June 25, 1993.*

Ticket Time

The FCC's enforcement division has been busy lately. Three Los Angeles area amateur radio equipment dealers have received Notices of Apparent Liability (NALs) in the amount of \$7,000 each for marketing the Kenwood TS-50S HF Transceiver which could be "... operated on frequencies not authorized for amateur radio use." The complaint apparently stems from a brochure which originally mentioned the rig's ability to operate above and below the ham bands.

This brochure has since been reprinted showing only the rig's ham band capabilities.

Four out-of-band CB operators are being fined from \$2,000 to \$3,500 each for their infractions. A fat \$10,000 fine has been levied against Lonnie N. Gwinn of Federal Heights, CO, for selling external CB RF power amplifiers at a truck stop.

Margaret G. Taylor of Windermere, FL, was told she owed the government \$2,000 for her unlicensed amateur radio operation.

Four computer companies were ordered to cough up from \$7,000 to \$10,000 each for marketing personal computers which did not have the proper FCC equipment approvals.

The Southern Railway Company was fined \$7,000 for refusing to allow an FCC inspection of their radio base station. *TNX W5YI Report, Issue #14, July 15, 1993.*

CQ Taxi!

The New York City Taxi and Limousine Commission has decided to ban the use of ham radio as a means of communications for Big Apple cabbies. The measure prohibits the permanent installation of amateur transceivers or accessories in NYC Medallion taxicabs.

The ruling was an apparent response to a bid by a trio of New York City drivers to equip every cab in Metropolis with ham radio. Local repeater groups joined the influential trade publication *Driver* in opposition to the proposal.

Drivers may still carry low power handhelds for personal communications during off duty times outside the cabs, but they must be turned off and kept out of sight while the taxi is in service. *TNX Westlink Report, No. 652, June 25, 1993.*

Israeli Hamsat Launch

The Israel Polytechnical Institute will launch its first satellite known as the *Gerwin-1* (formerly *Techsat-1*) from the Baikonur spaceport in Kazakhstan aboard a Russian rocket. Professor Guiora Shaviv, Director of the Space Research Department, said the satellite will weigh about 60 kg and will carry a packet BBS for ham radio operations.

The satellite from "Technicon," as the institute is known throughout the world, was a project which began three years ago and will be placed in orbit as a secondary payload along with a Russian satellite and a German satellite. *TNX Westlink Report No. 652, June 25, 1993.*

TNX . . .

. . . to all our contributors!

Computer Control for Beam Antennas, Part 2

Completing the project.

by Ron Cole K4OND

In Part 1 we reviewed how antenna rotators work, how to build a simple manual rotator control, and how to get a position readout in electrical form. We can now proceed to the ultimate—complete computerized control of azimuth and/or elevation. With a little hardware and software, you can implement a system which can automatically track a moving “target” (i.e., a satellite), automatically turn to the correct azimuth for a DX location or a selected repeater, or simply have fun using a

joystick to control something as big as an antenna. The discussion below assumes you are using an IBM PC or clone computer. If you have some other type of computer, you will still get some useful ideas, but you will have to design your own hardware interface and software.

First, let's look at how your computer can control one or more rotators, how it “knows” where your antennas are pointing, and finally, how to put the system all together.

Computer Interface

Somehow, we first have to get usable signals out of the computer. Although you could build your own interface unit (if you know enough about the internal workings of a PC), a quicker and easier way would be to buy a kit made for this purpose. JDR Microdevices (2233 Samaritan Dr., San Jose CA 95124) sells several such kits, or you can buy a completely wired and tested board from them. The JDR PCL-720 (\$169.95) is a

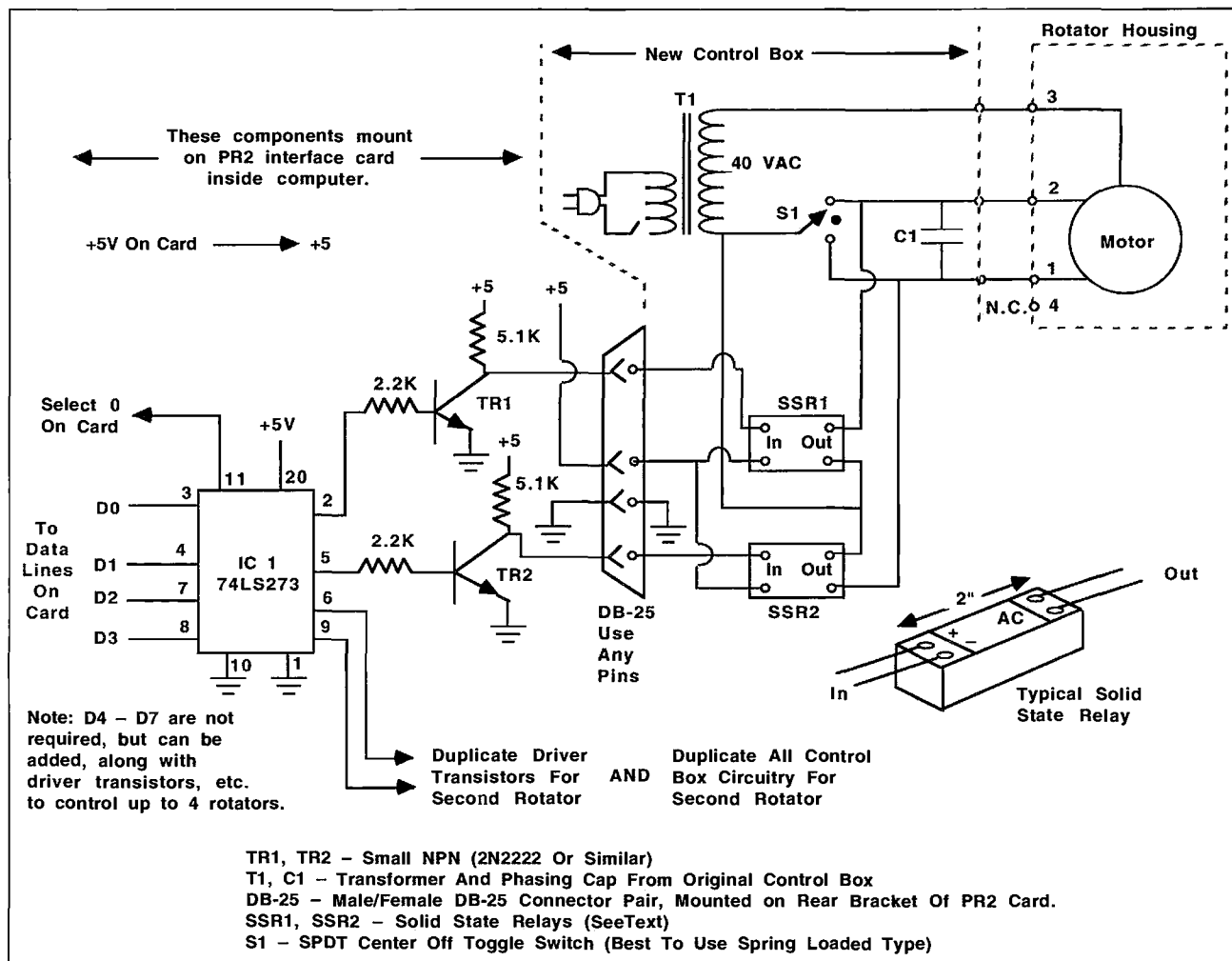


Figure 1. Computer control of rotators.

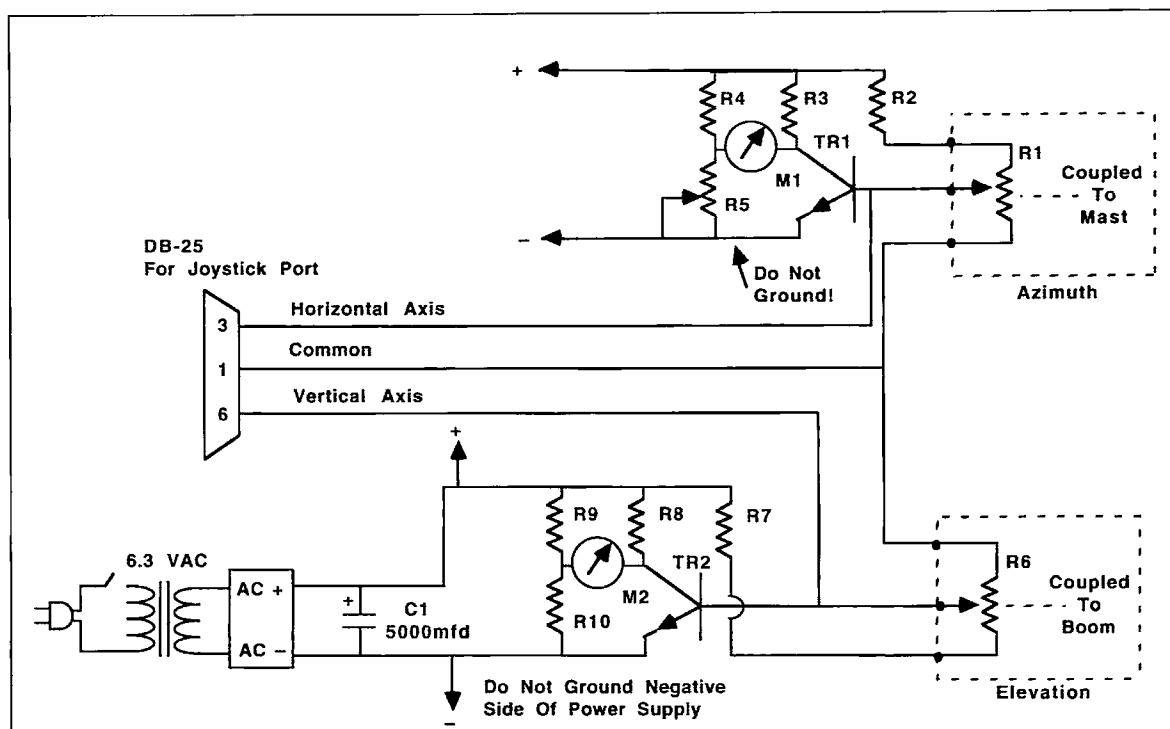


Figure 2. Using joystick port.

fully-assembled I/O card which has more than enough input and output channels for several other projects besides a rotator control. That card also includes three timer/counter channels which you may find useful, and some software drivers written in BASIC. I bought the JDR-PR2 "prototyping" kit (\$29.95), and the PR2-PK parts kit

(\$8.95) instead, and added the additional circuits and parts. Assembling my board took only about an hour, and it worked immediately upon installing it into a spare expansion slot on the motherboard. The instructions with the kit are quite clear, and JDR includes several suggestions for other projects using the board.

What the PR2 kit gives you is "decoding" of a block of input and output addresses; that is, it gives you the ability to send data to, or get data from, external devices by appropriate software commands. The PR2 kit actually gives you the ability to address up to 32 separate data ports, many more than you will need in our controller. It also has plenty of

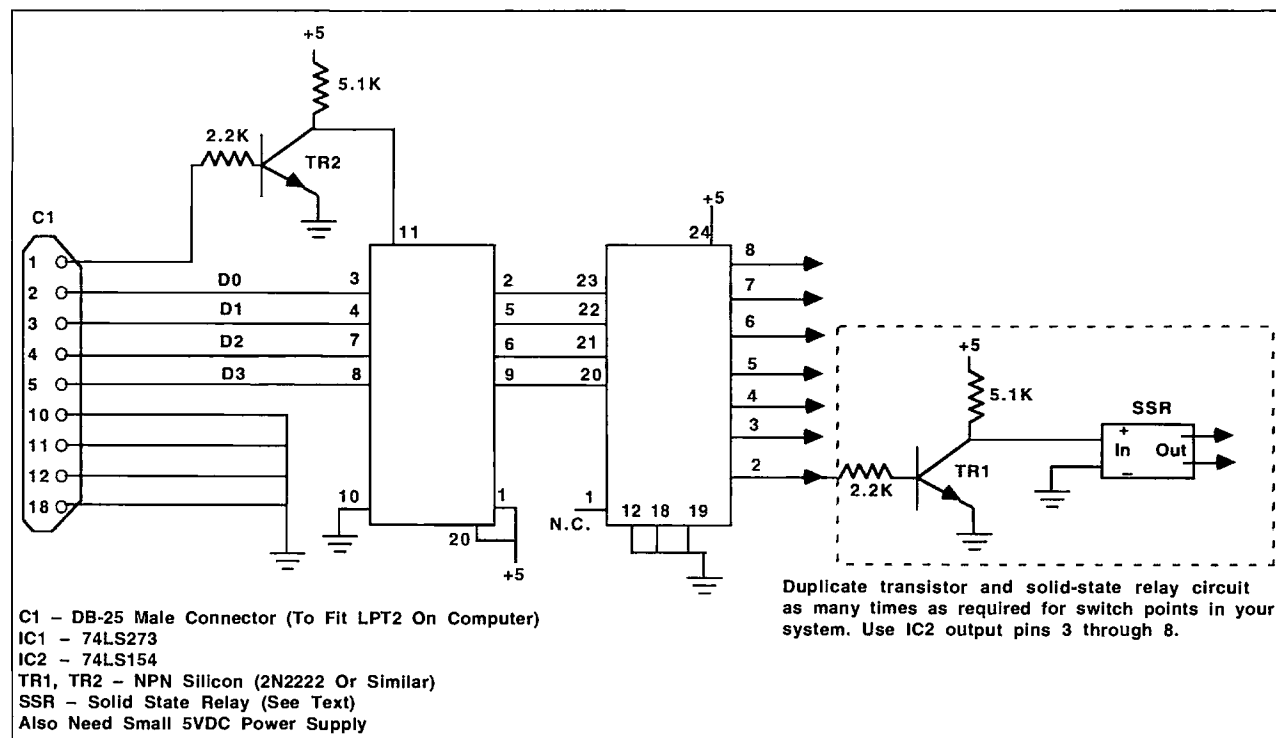


Figure 3. Quick and dirty interface.

room for the handful of ICs and transistors we will need.

A DIP switch which comes with the kit allows you to select the range of addresses for the ports. With switch 1 off (up) and the other three switches on, the address range will be from 768 to 799. As supplied, and without any further decoding, the PR2 actually decodes "blocks" of four addresses each: to make full use of all 32 addresses, you will have to add more decoders. However, for our purposes, we only need one port address. Let's decide to use address 768 for that port.

If you are familiar with the BASIC computer language, you probably recognize the software command "OUT x,n" which sends a number, n, (which must be between 0 and 255), to whatever device is connected to the data port at address "x." We need to have something at the data port to capture and store the data word, then operate a relay which will control the rotator. The "something" we need is an 8-bit data latch, the 74LS273 shown as IC1 in Figure 1. When the computer executes the "OUT 768,n" command, the 8 bits of data (whatever we send for "n") will come out on the data bus while a single "write strobe" pulse appears on the output line which has been decoded for address 768 (that is, the "Select 0" line in the case of the PR2 interface board). The write strobe latches the data into IC1.

For a little extra protection of the computer against accidents (since we are about to connect to the "harsh" external world), the output pins of IC1 are routed first to a set of driver transistors. In turn, the driver transistor outputs are routed to a DB-25 connector, which mounts on a bracket supplied with the PR2 kit. From the connector, a cable connects to our new control box, which contains the "solid-state relays." SSR1 and SSR2. (A "solid-state relay" is an integrated package specially designed for interfacing logic-level signals to high power levels in the real world. They require only about 3 volts on the input to operate, and at current levels easily provided by small transistors. They are much too large to fit on the interface board inside the computer, but we don't want them inside anyway, since they are going to be switching some voltages and currents, which could mean instant death to any other computer chips. (Note that if you want to test these relays, you must have a large AC voltage on the output side or they will not seem to work; you cannot test them with just an ohmmeter.)

We next wire the outputs of the solid-state relays in parallel with the manual switch (S1) described in Part 1 of this article. SSR1 applies our 40 VAC motor power to one side of the phasing capacitor to produce rotation in one direction, while SSR2 can apply power to the other side to rotate in the other di-

rection. When neither relay is on, no power is applied, and the rotator stops. If you wire the circuit exactly as shown in Figure 1, you can control the rotator with just three BASIC commands: OUT 768,1 causes rotation in one direction, OUT 768,2 rotates the other way, and OUT 768,0 stops all rotation. If you want to control a second rotator (i.e., for both azimuth and elevation) you will have to add two more driver transistors connected to IC1, two more wires down to the control box, and duplicate the transformer, phasing capacitor, solid-state relays, etc., in the control box. When wired to the data latch as shown, BASIC commands for the second rotator would be "OUT 768,4" for one direction, and "OUT 768,8" for the other direction, and, again, "OUT 768,0" to stop. (Unless you understand binary arithmetic, be a little careful of sending any other commands to port 768, since some data words will try to make a rotator turn in both directions at once! If you do understand the binary values involved, you can figure out how to control both rotators at once, but remember that the stop command (OUT 768,0) will stop both rotators, even if one of them needs to keep going longer.

Now that we have one or two rotators under computer control, let's see how the computer can determine where the antennas are pointing. Although the more elegant method would be to use a separate "analog-to-digi-

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CIRCLE 147 ON READER SERVICE CARD

A Quick and Dirty Interface

There is a sneaky way to achieve computer control of rotators which eliminates the requirement for building or buying an interface card, and requires almost no external hardware, but it depends on your familiarity with BASIC programming and your willingness to do some experimenting. First of all, you need a second line printer (parallel) port in your computer; it should be set up as printer port "LPT2." If you don't already have one, you can get an interface card for about \$20. The parallel printer port can be made to act very much like the output ports we created with the interface board described earlier. However, instead of sending data to an output port ("OUT 768,n", etc.), we are going to "LPRINT" the data to LPT2. External to the computer, we have to build a data latching circuit using a 74LS273 just as before. Then we will use a 74LS154 4-line-to-16-line decoder IC to interpret the data and activate

one of 16 output lines to cause rotator action. (One and only one of the 74LS154 output lines will go to the low level for each value of "n" between 0 and 15.) The low level outputs are routed to driver transistors, then to solid-state relays as before. Figure 3 gives the basic concept.

The quick and dirty way to get position readout depends on software only. It turns out that you can get a fairly accurate estimate of the antenna position by simply starting from a known point, then computing how many times you have to go around a software loop to use up enough time to rotate to the new position. That is, for example, if the antenna is known to be on an azimuth of 35 degrees, and you want to turn to 77 degrees, you can develop an algorithm which tells you that it takes "x" seconds to rotate 42 degrees. Then you start the rotation, go around a software loop ("FOR I = 1 TO n: NEXT I")

to create a time delay which is "x" seconds long, then stop the rotation. You will have to do some experimenting to find out what kinds of "x" and "n" values you need; these are highly dependent on your computer's speed and how fast your rotator actually turns. Be sure to include code in your program to save the most recent heading(s) for the next use, because the computer doesn't have any idea where the antenna is really pointing! (Engineers call this an "open loop" control system because there is no feedback from the thing being controlled.) You also need to save the last heading(s) to a data file before you turn the system off, and reload the file the next time you turn it on. Remember, also, that with this "quickest and dirtiest" method, you will have to run your antenna control program every time you want to move the antenna or see where it is pointing.

tal" convertor circuit, the easiest way to get into the computer is to connect the potentiometers into a "joystick" (or "game") port. Joysticks are nothing more than a pair of potentiometers, anyway. My system uses a game interface card made by Gravis. This card expects to see a joystick which has potentiometers of about 100k ohms each. The connections for the joystick port are shown in Figure 2. (Since most joysticks built for use with PC clones are interchangeable, the pin connections should be the same for any game card, but you should check by testing a joystick known to work with your comput-

er.) Note that one side of the potentiometers is common, but that the common line is not grounded, and you need to make sure your potentiometers are not grounded somewhere.

Unfortunately, that's not quite all there is to it. Back in Part 1 we used the rotator potentiometer to drive a meter circuit to display position, and this required applying a small voltage to the potentiometer. If you're like me, you want to retain that meter readout capability (along with the direction control switch, S1) so that you don't always have to run the computer. However, with

that voltage applied to the potentiometer, we cannot now simply hook the potentiometer directly to the joystick port because the game card expects to see a pure resistance only, not a voltage or current.

Figure 2 shows a way to simultaneously drive a meter and a joystick port from the same potentiometer. One side and the wiper of the potentiometer control the base current in an NPN transistor, which is one leg of a bridge circuit. The meter provides the manual-visual display. The other end of the potentiometer and the wiper are used as the input to the joystick port. Note that the transistor

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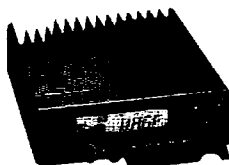
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FT-76, 440 MHz
FT-23R, 2 Meter
FT-33, 220 MHz
FT-470, 2M/440MHz

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50 MHz					
0503G	1-5	10-50	6	15/0.6	LPA
0508G	1	170	28	15/0.6	Standard
0508R	1	170	28	—	Repeater
0510G	10	170	25	15/0.6	Standard
0510R	10	170	25	—	Repeater
0550G	5-10	375	60	15/0.6	HPA
0550RH	5-10	375	60	—	Repeater HPA
0552G	25-40	375	55	15/0.6	HPA
0552RH	25-40	375	55	—	Repeater HPA

144 MHz					
1403G	1-5	10-50	6	15/0.6	LPA
1406G	25	100	12	15/0.6	Standard
1409G	2	150	25	15/0.6	Standard
1409R	2	150	24	—	Repeater
1410G	10	160	25	15/0.6	Standard
1410R	10	160	24	—	Repeater
1412G	25-45	160	20	15/0.6	Standard
1412R	25-45	160	19	—	Repeater
1450G	5	350	56	15/0.6	HPA
1450RH	5	350	56	—	Repeater HPA
1452G	25	350	50	15/0.6	HPA
1452RH	25	350	50	—	Repeater HPA
1454G	50-100	350	40	15/0.6	HPA
1454RH	50-100	350	40	—	Repeater HPA

220 MHz					
2203G	1-5	10-40	6	14/0.7	LPA
2210G	10	130	20	14/0.7	Standard
2210R	10	130	19	—	Repeater
2212G	30	130	16	14/0.7	Standard
2212R	30	130	15	—	Repeater
2250G	5	220	40	14/0.7	HPA
2250RH	5	250	40	—	Repeater HPA
2252G	25	220	36	14/0.7	HPA
2252RH	25	250	36	—	Repeater HPA
2254G	75	220	32	14/0.7	HPA
2254RH	75	250	32	—	Repeater HPA

440 MHz					
4403G	1-5	7-25	4	12/1.1	LPA
4410G	10	100	19	12/1.1	Standard
4410R	10	100	18	—	Repeater
4412G	20-30	100	19	12/1.1	Standard
4412R	20-30	100	18	—	Repeater
4448G	5	100	22	12/1.1	HPA
4448R	5	100	22	—	Repeater HPA
4450G	5-10	175	34	12/1.1	HPA
4450RE	5-10	175	34	—	Repeater HPA
4452G	25	175	29	12/1.1	HPA
4452RE	25	175	29	—	Repeater HPA
4454G	75	175	25	12/1.1	HPA
4454RE	75	175	25	—	Repeater HPA



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144 MHz	1420N	.5 24	N
220 MHz	2220B	.5 22	BNC
220 MHz	2220N	.5 22	N
440 MHz	4420B	.5 18	GNC
440 MHz	4420N	.5 18	N
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Joystick Antenna Control Program Segment

```

100 REM - ROTATE CW
110 WHILE STICK(0)**65
112 OUT 768,1
116 WEND
118 OUT 768,0: REM - STOP ROTATION
120 REM - ROTATE CCW
122 WHILE STICK(0)**35
124 OUT 768,2
126 WEND
128 OUT 768,0: REM - STOP
130 REM - ROTATE UP
132 WHILE STICK(1)**65
134 OUT 768,4
136 WEND
138 OUT 768,0: REM - STOP
140 REM - ROTATE DOWN
142 WHILE STICK(1)**35
144 OUT 768,8
146 WEND
148 OUT 768,0: REM - STOP
150 GOTO 100
    
```

and meter portion of the circuit use a "floating" power supply—the negative side of the supply must not be grounded or you can accidentally ground one side of your joystick, with possible damage to the game card. In this application, you need to use a rotator potentiometer (R1) of about 100k ohms since the game card expects such a value in the normal joystick application. Also, pick a linear-taper potentiometer for R1, again to emulate the joystick.

I have also used one other method to get both a meter display and a joystick port driver. That method involves putting an LED diode in the collector circuit of the transistor, and optically coupling the LED to a cadmium-sulfide photoresistor (Radio Shack 276-1657). The CdS photoresistor has a "dark" resistance of at least 100k ohms, and can go down to less than 100 ohms with just the light from an LED. The CdS photoresistor can then be connected directly to the joystick input lines. With this method, there is no electrical path between the meter circuit and the computer, only a safe optical coupling. I assembled the LED and photoresistor unit by inserting the devices into opposite ends of a 1/2" piece of heat shrink tubing. Even after shrinking, enough light leaked in that I had to cover the whole unit in black electrical tape. (Do not try using a "phototransistor" for this purpose; they just don't seem to work, but the CdS cells work fine.)

If you are going to use either of these methods, be prepared to do some amount of juggling of the values of components in the circuit. The hardest part of all is to find a set of components which will produce a linear scale on the meter (that is, without having half of the antenna movement squeezed into one-fourth of the meter scale, etc.). On the joystick side, true linearity is less important since we have to build a look-up table in the software to translate "joystick" values to azimuth and elevation angles anyway.

And Just for Fun . . .

If you have at least one joystick port still

available, and a joystick, it is really easy to control your antenna with it (and fun to steer something as big as an antenna with a joystick!) Let's assume that the horizontal pot on your joystick appears as "STICK(0)" in BASIC, and the vertical pot appears as "STICK(1)," and that the STICK values are 50 when the joystick is centered. Let's further assume that you used output port 768, with OUT 768,1 meaning rotate clockwise, OUT 768,2 meaning rotate counter-clockwise, OUT 768,4 meaning rotate up, and OUT 768,8 meaning down. Then the "joystick" part of your BASIC program could look something like that shown in the list at left. You need to add more code to break out of the infinite loop of the program, and to display the position as the antenna moves.

All Together Now

Software is the "glue" which sticks the system together. Now that you have the ability to start and stop rotator(s), control their direction, and get computer feedback on antenna position, you can do almost anything you want via software. If you can write programs in BASIC, the preceding discussions are probably as much as you need to put together a working program. If not, a sample package is available from the 73 BBS (603-924-9343) or address (ppn 70310.775) on CompuServe. For \$5, a blank (formatted) disk, and a suitable (padded) SASE, I will also send you a package which includes programs for building your own look-up tables, automated heading menus, graphical (compass) displays, "quick and dirty" timing algorithms, etc., with lots of textual explanations (address: HC 69 Box 1150, Moncks Corner SC 29461). Most programs will be in BASIC, but some have also been compiled to run under DOS. What I don't have (yet), is a program which tracks satellites from ephemeris data, then feeds the real-time position information to an antenna control program for complete autotrack. I would love to hear from anybody who knows of a good tracker, available in BASIC, which can be merged with a controller program.

Parts Availability Notes

JDR Microdevices, 2233 Samaritan Dr, San Jose CA 95124, sells cards for PC clone interfacing. The general-purpose "Prototyping" I/O used in this article is the "PR2" card (\$29.95). It is a "full-size" board, plugging into an empty "8-bit" slot on the motherboard. The PR2 has printed wiring for address decoding, saving a lot of time. Save more time by getting the PR2-PK parts kit. (\$8.95) Good instructions come with the kit, along with a complete schematic.

All Electronics Corp. (P.O. Box 567, Van Nuys CA 91408; 800-826-5432) usually carries solid-state relays. If not, try Digi-Key (701 Brooks Ave. South, P.O. Box 677, Thief River Falls MN 56701-0677; 800-344-4539) or Surplus Sales of Nebraska (1502 Jones St., Omaha NE 68102; 402-346-4750).

Radio Shack has almost everything else you will need, except maybe the 74LS273 ICs, but these are carried by most parts houses, including Digi-Key.

The W2EKY "Icky-Stick" Antenna

Hit the roof with an improved ground-plane vertical.

by Ronald B. Koester W2EKY

I lost virtually my whole shack in a fire, and purchasing a replacement rig left me little cash for an antenna or antenna tuner. My first inclination was to put up the proverbial dipole, which usually requires tree climbing (me chicken) or the tools used by Robin Hood. I opted for neither.

My favorite band is 15 meters. This band, combined with the slope of my new shack, made the situation right for a ground-plane antenna. But any connoisseur of antenna theory knows a vertical antenna is only as good as its counterpoise. The traditional ground plane with the usual four drooping radials has a performance only about equal to that of a vertical dipole.

Being an old fan of cubical quads and their broad bandwidth, I decided to use two quad loops in place of four radials to try to improve overall performance, laying the loops on each side of the roof. I used 14-gauge plastic-covered wire, but you can try using whatever happens to be in your junk box.

The wire loop corners can be secured with nails or hooks (see Figure 1). The Icky-Stick is fed with RG 58/U or RG8/U. Using 21.3 MHz as the design center, the height calculates to be:

$$H_{\text{feet}} = \frac{246}{\text{Freq. MHz}} = 11 \text{ feet } 6 \text{ inches.}$$

Each loop length is calculated by:

$$L_{\text{feet}} = \frac{1005}{\text{Freq. MHz}}$$

= approximately 47 feet.

Construction

The antenna is constructed of two pieces of 3/4-inch (i.d.) aluminum electrical conduit, a 2-foot piece of 1-inch (i.d.) PVC plastic pipe, a 3-foot tripod and #14 wire.

The first section of conduit is cut to a length of 5 feet and is joined with the upper section with a pipe union (usually supplied with conduit). This allows the upper section to be easily removed and pruned (great fun in a high wind) for the lowest SWR. The lower section is drilled to accept 2-10/24 brass machine screws and nuts 1 inch in length (see Figure 2). Secure the loops with soldering lugs and wing nuts.

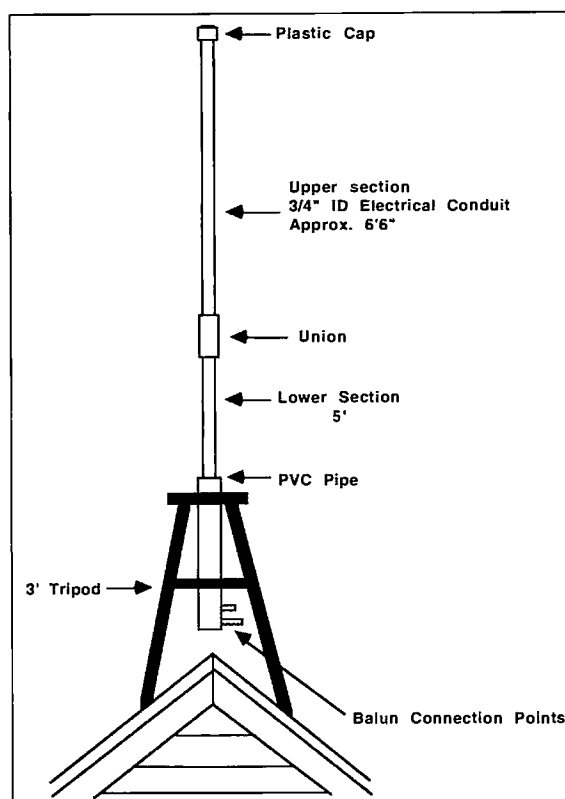


Figure 3. The W2EKY (Icky-Stick) Antenna.

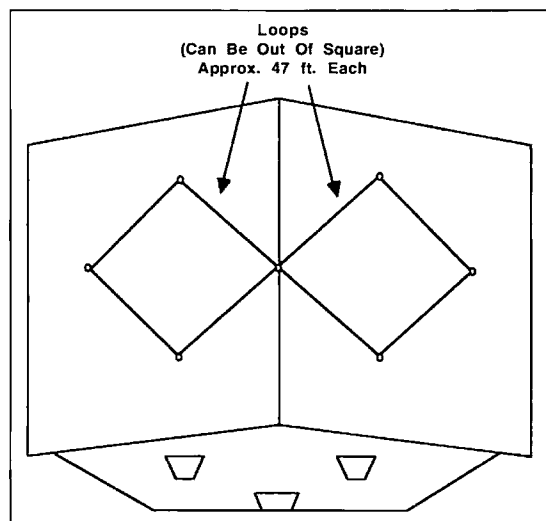


Figure 1. Ground plane detail.

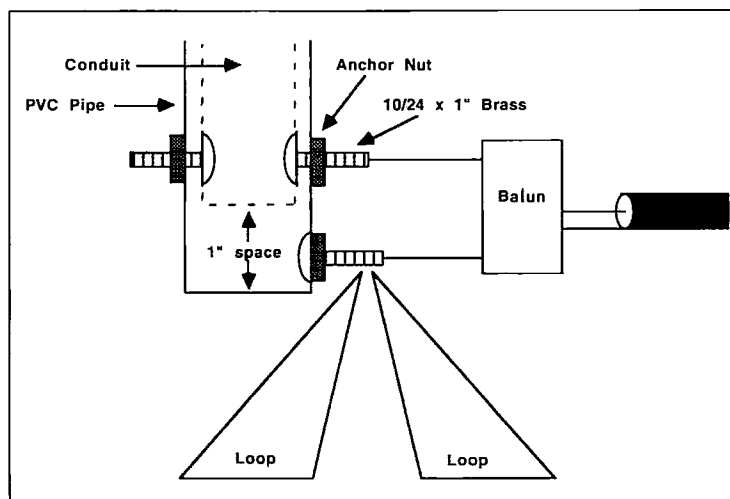


Figure 2. Antenna base detail.

The bottom of the radiator is insulated from the tripod by the 2 feet of PVC pipe. Unfortunately, the PVC pipe does not slip over the conduit unless it is split along its entire length. This is easily accomplished with a radial arm saw or bench saw.

After spraying the first 2 feet of the bottom conduit with WD-40, tap the PVC pipe on. Make sure that a 1-inch space is left between the bottom of the conduit and PVC. This space allows for connecting the balun transformer and loops. I suggest that you use soldering lugs on the wires.

"All the signals I could hear I could work, and with strength equal to or better than that received."

Performance

All the signals I could hear I could work, and with strength equal to or better than that received. It appears that the vertical pattern is at a lower angle due to the loop counterpoises. Interestingly, the Icky-Stick showed a low SWR across the entire band. I also attribute this to the loops. I recommend that the coaxial cable be fed *between the loops*, as I did note some interaction at this QTH. Although the Icky-Stick can be fed directly with coaxial cable, I strongly recommend that a 1:1 balun be used. Without the balun there is a strong chance of TVI and pattern skewing.

As with any vertical, antenna gain would increase if the length of the radiator were increased to 1/2 or 5/8 wavelength. This, of course, would require the use of guy wires (uh-oh).

Happy DX!

73

Parts List

2 ea.	10-foot, 3/4-inch i.d. electrical aluminum conduit/with union
1 ea.	10-foot, 1-inch i.d. plastic PVC pipe (only 2 feet needed)
100 feet	Insulated wire, #14 or what is in the scrap box
1 ea.	3-foot tripod
2 ea.	10/24 brass round head machine screws with nuts, 1 inch long
2 ea.	Brass wing nuts, 10/24
6 ea.	Soldering lugs, #10 hole
1 ea.	Balun transformer 1:1, unbalanced in, balanced out RG 58/U or RG 8/U, as needed



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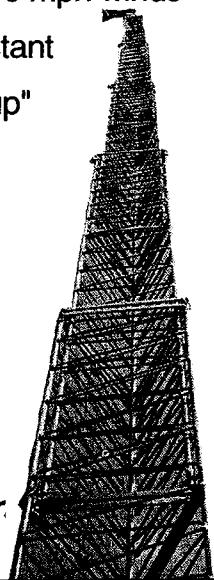
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Compressing the W3EDP

Build this unique multiband restricted space antenna.

by Richard Q. Marris G2BZQ

The W3EDP antenna first appeared around 1936. It was, at that time, an unorthodox multiband antenna design, in as much as it consisted of an 84-foot end-fed wire plus a 17-foot counterpoise, and no ground connection. It was usable on the 80, 40, 20, and 10 meter bands using the same 17-foot counterpoise, except that on 20 meters 6-1/2 feet was suggested. Some people also used it on the 160 meter band. The whole thing was resonated by a coil "L" and variable capacitor "C" (see Figure 1). The coupling coil was connected to the TX output with feedline. Various explanations have been offered over the years as to how the design was arrived at, and how it works, but the truth seems to be that this multiband antenna and counterpoise lengths were originally arrived at by lengthy "cut and try" experiments.

From time to time over the years the W3EDP has "raised its head" in a textbook or magazine and then disappeared again for a few more years. During recent years the W3EDP seems to have proved quite popular among the QRP folk in Europe.

It seemed, to the writer, that if the W3EDP could be really shortened (or compressed) it would make a very useful restricted space antenna for the 80 meter band, and experiments along these lines were carried out, every time keeping the 17 feet counterpoise.

The most obvious idea was to make a

helical version about eight feet long, mounted horizontally. With a helical antenna, a "rule of thumb" method is to wind twice the normal length of wire on an insulated rod or tube, and prune down to resonance by removing a few turns at a time. Therefore, 175 feet of wire was wound around a piece of 1-inch o.d. PVC tubing. Using a 17-foot counterpoise, turns were gradually removed until all the 80 meter band could be tuned using L and C, as in the full-size W3EDP. The contraption

"With the final design, it was possible to work throughout Western and Eastern Europe using CW between 3500 and 3600 kHz and about 10 watts CW."

worked, but was very narrow bandwidth, and C had to be retuned every few kHz. So a non-helical approach, to compress the antenna, was investigated, with the result being a 30-inch diameter end-fed spiral arrangement (see Figure 2). A further improvement in coupling and bandwidth was made by tapping the coaxial feedline onto L in lieu of the original coupling coil. The antenna was tested mounted both vertically and horizontally. Vertical gave the best results.

Using about 10 watts CW, with the new antenna standing on a coffee table in the

middle of the room, and with the 17-foot counterpoise lying on the floor, it performed very satisfactorily. The construction was modified so that the spiral winding was halfway between the ceiling and floor. About 16 feet of RG58 feedline went to the TX via an existing "T" match ATU, located alongside the TX/RX. This ATU eliminated all TVI, which had been slightly present when the feedline went direct to the TX output.

With the final design, it was possible to work throughout Western and Eastern Europe using CW between 3500 and 3600 kHz and about 10 watts CW. (The antenna will cover the whole of the 3.5 MHz band.)

Once adjusted, the variable capacitor C was "locked" as it was not necessary to retune it. The counterpoise length was changed +/-, but 17 feet gave the best matching and results, as per the original W3EDP. Furthermore, the counterpoise, made of well insulated wire, could be laid either straight, zig-zag, or in "L" or "U" shapes on the floor, with no noticeable change in performance.

Construction

The antenna consists of a 30-inch diameter end-fed spiral winding, wound on an octagonal shape timber mainframe (see Figure 4). The mainframe (see Figure 3) consists of four lengths of timber, each 30" x 5/8" x 1/4". A hole is drilled in the center of each, and glue is applied around the

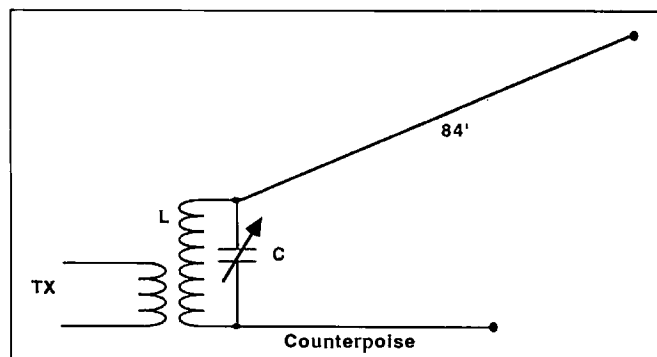


Figure 1. The W3EDP.

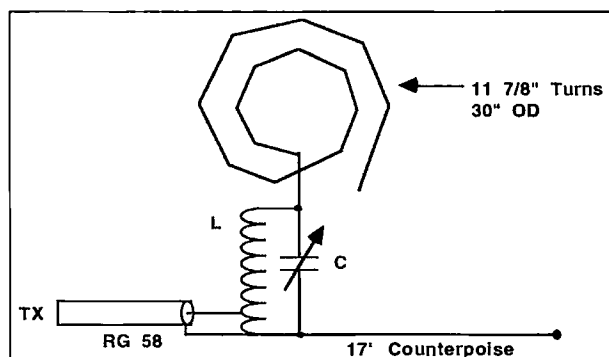


Figure 2. The compressed W3EDP.

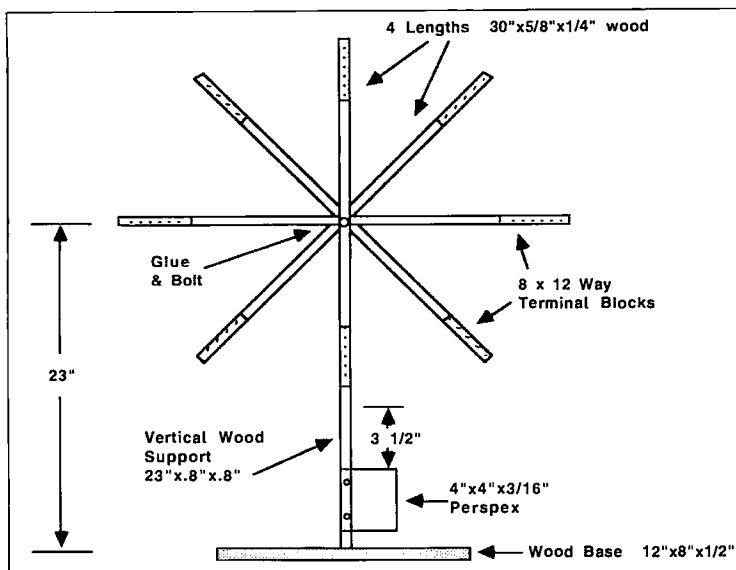


Figure 3. Mainframe construction.

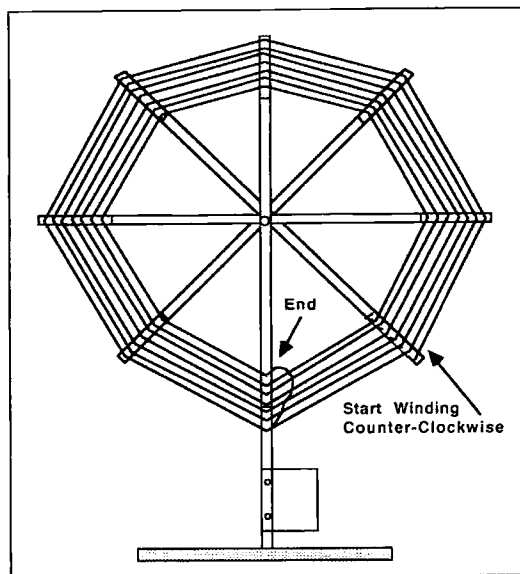


Figure 4. Winding detail.

holes on each timber length. The whole is secured with a bolt, nut and washers. The timber "radial spokes" are arranged in the configuration shown in Figure 3, then the nut and bolt are securely tightened to hold the "spokes" in position while the glue is hardening.

A vertical wood support 23" x 0.8" x 0.8" is screwed and glued to a 12" x 8" x 1/2" timber base, as shown in Figures 3 and 5. The fan of radial spikes is bolted to the top of the vertical support (see Figure 3). The whole mainframe assembly can now be wood-stained.

At the end of each radial spike, a standard 12-way 2 amp polythene terminal block is secured with wood screws, and a piece of Perspex sheet measuring 4" x 4" x 3/16" is mounted, as shown, with two wood screws with washers under the heads (see Figures 3 and 5). [Editor's note: Polythene is the British variation of polyethylene, and Perspex is the British trademark for a hard transparent plastic similar to Plexiglas.] The 250 pF variable capacitor C is mounted on the Perspex sheet, as shown in Figure 5.

Assuming low power operation, a good quality well-spaced receiver type variable capacitor can be used. Alternatively, a 2-

gang 500 + 500 pF variable can be wired in series. Remember that this VC is not at true ground potential, and is therefore mounted on the Perspex plate and fitted with a shaft coupler, insulated shaft, and a 3" diameter instrument knob (see Figure 5).

The B & W Miniductor coil (type 3047) is vertically mounted on a couple of small insulators. On 80 meters the whole of the coil L is connected across the variable capacitor. The coaxial feedline is tapped up from the bottom of the coil for the best coupling point. As a guide: On the prototype, and using RG58 feedline, this tap point was 7-1/2 turns, but it is well worth experimenting with the tap position for best results.

The winding of the spiral antenna, using PVC-covered stranded hook-up wire, is clearly shown in the winding detail (see Figure 4.) The turns are wound counter-clockwise through the holes in the 12-way terminal blocks. At every complete turn the terminal block grub screw should be tightened just enough to hold the wire taut before winding the next turn, and so on.

The counterpoise is the inner polythene-covered conductor removed from a length of RG58, and is clipped on at the junction of C and the bottom of L, as shown in Fig-

ures 2 and 5. The coaxial feedline should be secured to the wood base with a couple of cable cleats (see Figure 5).

Operation

Initially, the antenna should be tested with a receiver on the 80 meter band. At 3500 kHz the prototype was resonated with variable capacitor (C) plates about 50% en-meshed, and was found to give a real lively reception performance over the whole band.

Next, the antenna should be fed with a few watts from the TX. An existing "T" type ATU, adjacent to the TX, was an advantage in matching and in eliminating TVI, which was slightly present when the antenna was connected directly to the TX output. Alternative coil taps on L should be tried to achieve the best loading and lowest SWR.

Assuming that the antenna is located in the middle of the room, one resonance setting of C should suffice over 100 kHz+. At this QTH, for use between 3500 and 3600 kHz CW, C was resonated at 3550 kHz and then "locked."

Other Bands

The prototype compressed W3EDP was

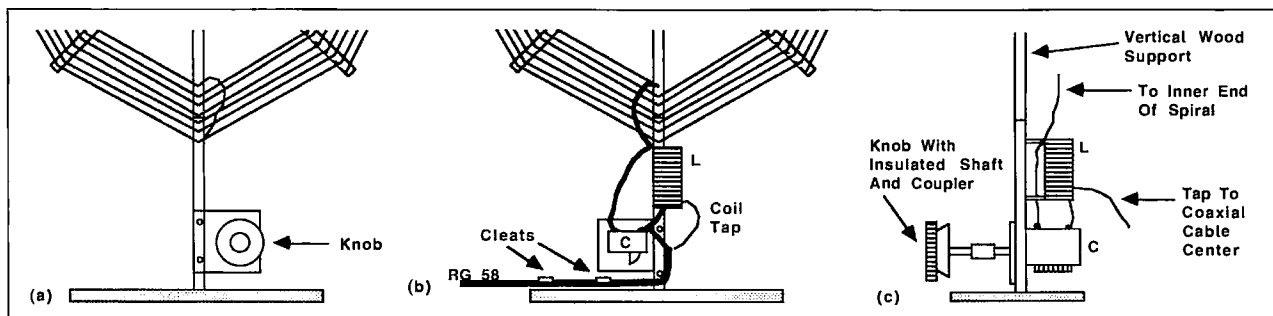


Figure 5. Mounting L and C: A) front view; B) rear view; C) side view.

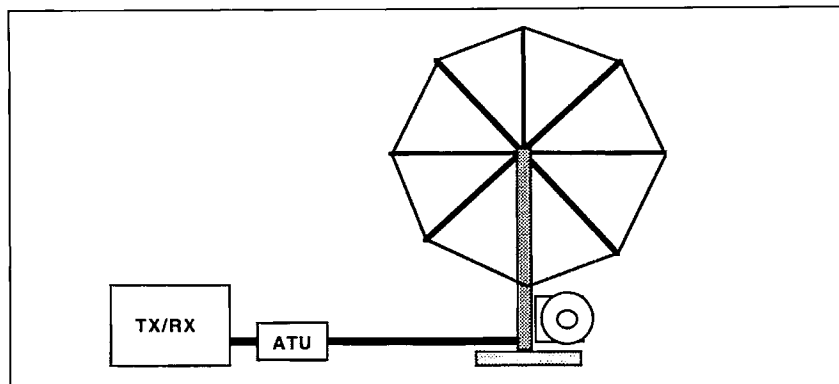


Figure 6. The finished product.

only required for use on the 80 meter CW band, but there seems to be no reason why it should not be used on 40, 20 and 10 meters (using a 6-1/2-foot-long counterpoise on 20 meters) as in the original W3EDP design. This could be done by tapping the coil L from the top, and moving the coaxial feedline tap. A convenient method would be to make 3-pin plug-in coils. The smaller higher frequency coils could be made of 16- or 14-gauge self-supporting tinned or silver-plated wire. Alternatively, the existing B & W coil could be switched using a ceramic switch.

There is much for the experimenter to try.

Alternative Ideas For the Experimenter

A couple of variations are worth mentioning:

1. The height of the spiral antenna winding can be increased by lengthening the vertical support section between the perspex plate and the wood base.

2. No doubt the antenna could be used in a loft, on a flat roof, or other outdoor site, and weatherizing the device would be necessary, and L and C sealed in a suitable box.

Parts List

C	250 pF variable capacitor (see text)
L	B & W Miniductor type 3047
Wire	PVC stranded hook-up wire (Radio Shack 278-1218 or similar)
Coaxial feedline	RG 58 (16 feet used on prototype)
8	12-way 2 amp polythene terminal blocks
1	Wood base 12" x 8" x 1/2"
1	Vertical wood support 23" x 0.8" x 0.8"
4	Wood spiral supports 30" x 5/8" x 1/4"
Perspex	4" x 4" x 3/16"
	3" diameter instrument knob plus 1/4" shaft coupler plus 1/4" insulated shaft (and slow motion drive, if required)

Conclusion

The compressed W3EDP prototype proved to be a very effective restricted space antenna. As a monoband 80 meter antenna, during spasmodic operating periods, it has been possible to work all over West, East, North and Southern Europe from a QTH in the south of England. Operating has been restricted to between 0415 and 0530 GMT, when conditions are not at their best. No attempt has been made to work during the nighttime DX hours—the writer has reached an age when he prefers his bed.

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Distributed Capacity Twisted Loop

An indoor 40 meter antenna for five bucks.

by Jim McLelland WA6QBU

I am one of those unfortunate hams who lives in a neighborhood which does not allow visible outdoor antennas. To make matters worse, the HF bands continue to deteriorate, and I have found it increasingly difficult to communicate after dark without a decent 40 meter antenna. Therefore, I had to find a solution: The Distributed Capacity Twisted Loop. The DCTL was designed for indoor and portable use on the lower high frequency bands. The requirements were: The antenna had to be small, cheap (less than \$5), easy to build, constructed of easy-

to-find parts, simple to adjust, and work reasonably well.

The following project constructs a flexible loop style antenna that hangs up almost anywhere (I drape it from my bookcase) and can work all over the Western U.S. and Hawaii on 40 after the higher bands have closed up. Moreover, I hear some DX and I can null out (down 30 dB) broadcast stations by rotating the DCTL on a camera tripod. It is quiet to boot! Interested? Read on! Or better yet, spend \$5 and an hour of your time and build one yourself.

Description

Referring to the schematic (Figure 1) will probably tell you all you need to know. Since this is an experimental antenna that I am continuing to adapt to different situations and bands (160 meters is in the works), many construction details are left to the builder.

The DCTL is a 15' 7" equilateral triangle made from 300 ohm TV lead-in (Radio Shack 15-1153); this is the narrower 5/16" variety. Spacing affects the dimensions so stay with this type of lead-in. The resonant frequency can be lowered by making the open stub longer. With no stub, the antenna resonates at 7.250 MHz, and with a 2" stub, it resonates at 7.050 MHz. I use a 1" stub and a tuner to go anywhere I want on the band. I also use the same low-loss twin-lead into the balun on my tuner—which I strongly recommend because the bandwidth is less than 100 kHz.

The DCTL has an impedance of 5.5 ohms and matching to 300 ohm line is accomplished with a 27-1/2" shorted stub across the feedline at the antenna. This is known as a "hairpin match" and adds some inductance to the antenna and lowers the resonant frequency. With a 50 ohm system (see "Tuning and Experimenting"), the hairpin stub is shorter and therefore the antenna requires a longer open tuning stub (capacitance) to make up for the loss in inductance.

A very important point that must not be overlooked is that the loop has a half-turn twist in it. This means that the feedline is not only connected to opposite ends of the loop but also to opposite sides. To be sure you are doing this right, use an ohmmeter to check for *no continuity* before you hook up the shorted stub and feedline. This lets the insulation act as a high quality capacitor between the antenna legs, which lowers its resonant frequency. With this system, approximately 1/8 wavelength acts like a half-wavelength system. The open stub just adds a little more capacity to the open opposite ends of the antenna so it can be tuned across the band.

Construction and Installation

To make this antenna work properly, solder all connections and insulate well with

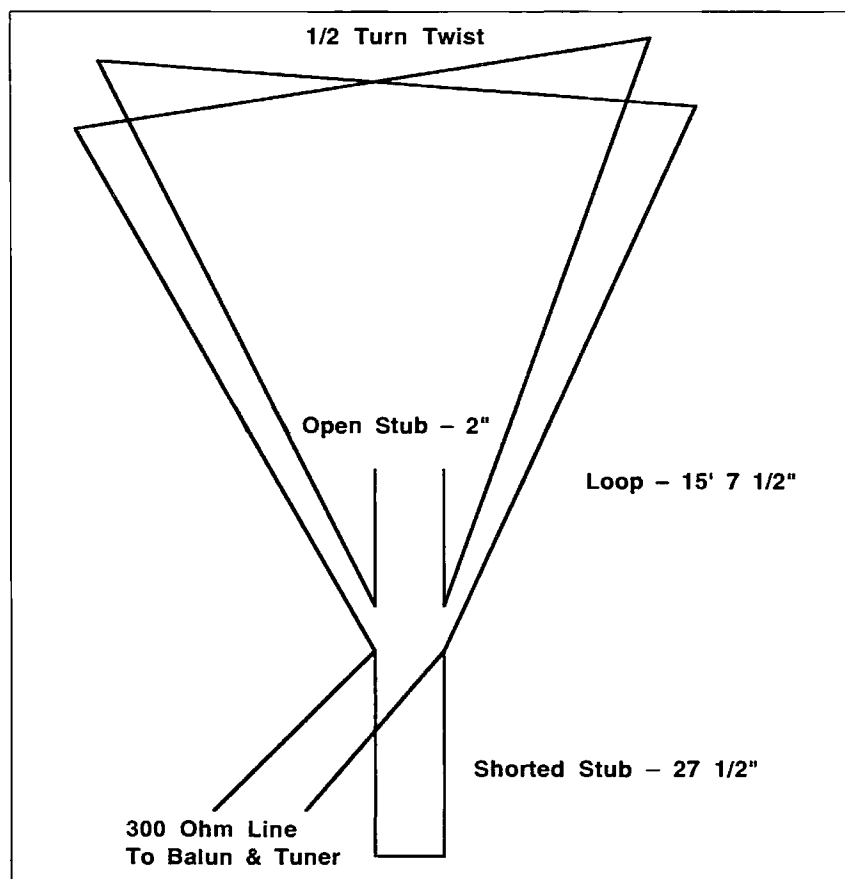


Figure 1. The Distributed Capacity Twisted Loop 1/8 wave antenna stands five feet high.

electrical tape and shrink tubing. Measure very carefully, remembering that an extra 2" can put you clear out of the band. Hang as an equilateral triangle with the apex and feedline down, staying away from metal such as housewiring, vents, downspouts, flashing, rain gutters, and windowsills. Lastly, do not use staples to hold the thing in place. As a safety note, *remember that loops have high voltages and high currents. Therefore, don't let anyone (including dogs, cats, kids, or the XYL) touch it.* I've used it with a 100 watt rig with no smoke or sparks yet, but I'd still be very careful.

Tuning and Experimenting

If you only have an antenna tuner, balun and SWR bridge, build the DCTL as described, tune it for 1:1 SWR using low power (I fried my internal balun by not doing this), and look for a QSO. As a side note, an external balun is better than the small internal units most tuners have. Another good alternative is to put RF beads or two of the clip-on RF forms Radio Shack sells on the

coax leading to the rig. Any ground wires then go only to the rig, leaving the tuner isolated.

If you want to play a little, here's some more information: I used an MFJ Antenna Bridge for all my initial measurements. A longer open stub lowers the resonant frequency, a longer shorted stub raises the impedance and lowers the frequency, and the shape affects everything somewhat. If you want to use 50 ohm coax directly, use an open stub of 9", a shorted stub of 8-1/2", and clip 1/4" pieces off the open stub until minimum SWR is centered where you want it. You should also coil some coax at the feed point to make a balun (or use one of Radio Shack's cute little forms that I mentioned earlier, winding 10-15 turns of RG-174 on them). Actually, however, I can't tell the difference with or without the balun. Theoretically, the null point on one side of the loop disappears but there is so much pattern distortion inside a house that it really doesn't seem to make any difference. Remember that if you want to use this antenna without a

tuner, its bandwidth is only about 100 kHz. If you have a tube rig with a pi-network and a balun, it's no problem, but the new solid-state rigs are another story.

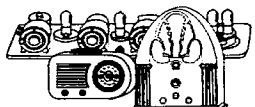
Field Tests

The first station I worked was near Seattle, about 1,000 miles away. Signals were good (7-9) on both ends and the op could hardly believe that my antenna was only 5' high. The next guy was in Salt Lake—same story. Later the same evening I worked a station in Hawaii—he kept saying, "You've got what kind of antenna?" The signals were not very strong but they were quite readable, except for the Pennsylvania station that couldn't hear either of us and kept calling CQ.

As a final note, if you can carefully rotate the antenna, you can really null out broadcast stations. While holding it over my head and rotating it (good thing nobody saw me doing this), I could reduce a 20/9 broadcast station to S7. I think I've got something here, folks.



73

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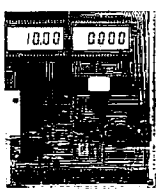


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Evolution of an Antenna

Build a new version of the classic "Lazy H" antenna.

by Sidney Rexford W2TBZ

Not much is new in the design of antennas, and most of the new can be traced to the old. After all, almost 100 years of antenna experimentation has exhausted most of the configurations imaginable. The antenna described in this article is a case in point. Basically, this antenna is a "Lazy H," a vintage workhorse which has an impeccable reputation as a stellar performer.

Let's review the old before going on to the newer version. The classic "Lazy H" is shown in Figure 1. It consisted of four half-wave radiating elements, two side by side over two more also side by side, with all four elements fed in phase. The array's gain will vary as the spacing between the upper and lower elements is varied from a half wavelength to a quarter wavelength, with the greater spacing giving slightly more gain than the lesser spacing. In practice, few hams could get sufficient height while erecting their antennas to make much more than quarter-wave spacing practical, so the evolution of this new version is based on quarter-wavelength spacing. By removing the old feed system and leaving just the radiating portions of the antenna, we find that just the four half-wave elements shown in Figure 2A will do the job.

In electrical circuits (and antennas are no exception), when two points exist with the same polarity and phase relationships, these two points can be connected together. The ends of both the upper and lower pairs of half-wavelength radiating elements fit this condition, so the ends of the lower half-wave elements can be bent up and those of the upper half-wave elements bent down to meet. They are then fastened together. This forms two loops separated by a quarter wave, as shown in Figure 2B.

Our antenna now has become two quad loops in phase and will be treated as such. It is important to realize that the end effects taken into consideration in the original "Lazy H" antenna computations to deter-

mine the length of the elements have been altered and the current formula for the overall length of the loops is now 1005 divided by the frequency in MHz. This is the standard formula used in determining the overall dimension of full-wave loops.

Obviously, the feed system used in the original "Lazy H" antenna is no longer practical to feed the new loops. The old phasing lines and the tuned feeder were located high in the air and were difficult to work with. A newer and more modern feed system is necessary. If the loops are opened in the center of the bottom of the loop, and you check the radiation resistance, you will find that it is 100 to 130 ohms, depending on height and ground conductivity under the loops. These points on the loops must be fed in phase and with equal voltages to come up with a working antenna. The most difficult part of the problem is in choosing the manner in which this is done.

A half-wavelength piece of transmission line of any type will act as a 1:1 transformer and reflect the terminating impedance at both ends, so a half-wavelength of transmission line (any transmission line) attached to the loops will appear to have an impedance equal to the impedance of the loop itself. A little experimenting with various types of lines determined that either standard 300 ohm ribbon or 450 ohm ladderline worked best. Coax was tried, but unless a 1:1 balun was used at each loop, radiation from the braid became a problem. The ribbon or ladderline was self-canceling and did not present any distortion of the antenna pattern.

A half-wavelength line from the center of each loop, brought together and fastened in parallel so that the loops are fed in phase, provides an impedance of 50 to 60 ohms, and a 50 ohm coax feed from antenna to hamshack will give an excellent match

without a tuner. To prevent radiation from the coax braid, a 1:1 balun should be used. A W2DU balun was used on this antenna. Ferrite core baluns were also used successfully. The use of air core baluns proved disappointing and they are not recommended. Construction details are shown in Figure 3, and dimensions for the loops and the phasing lines are shown in Table 1. As long as the termination (ends) of the ladderline or ribbon phasing lines are mechanically constructed so that flexing is distributed over at least a foot, the lines can be left to swing in the breeze.

This is a single-band antenna, and it is bidirectional. For the 40, 17, 20 and 15 meter bands rotation to provide full directional coverage would be a real challenge, but for 10 and 12 meters, a rotatable framework is feasible.

While the theoretical gain of this array is about 3 dB over a dipole, on-the-air results are better. The antenna is a lower angle radiator than the dipole at the same maximum height and, in the tradition of the "Lazy H," it does a fine job in DX contacts. Radiation patterns for the "Lazy H" can be found in just about any antenna handbook, but for those who do not have one handy, I have included a computer readout prepared by WA4HTR (now a Silent Key) and W4TDI, using the W7EL ELNEC program (Figures 4A and 4B).

Good luck to anyone who builds one of these antennas. I will be glad to answer any questions you may have, just include an SASE (RFD 1, Box 583, Colton NY 13625). And, if you have the space to build one for 40 or 80 meters, I would appreciate a report on the results. Fortune has never smiled on me—I have never had sufficient height to construct one of these.

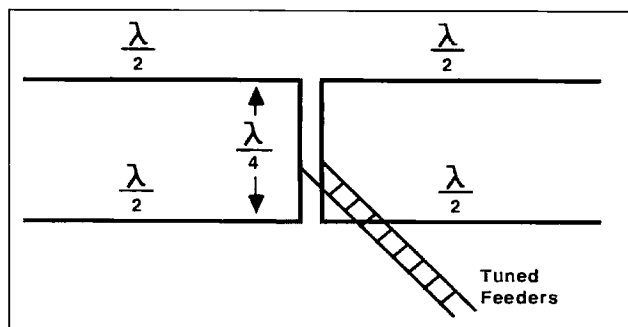


Figure 1. The classic "Lazy H" antenna.

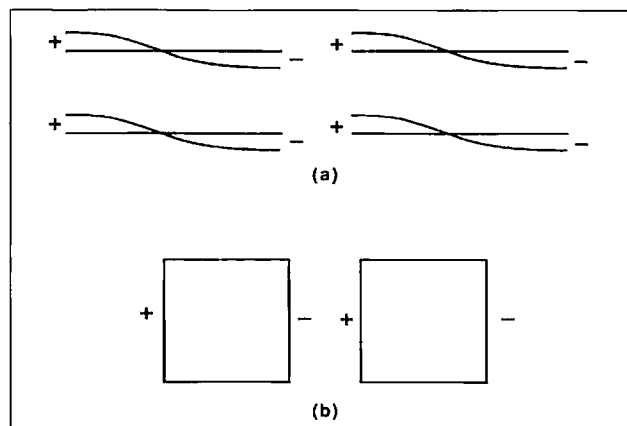


Figure 2. Evolution to two full-wave loops.

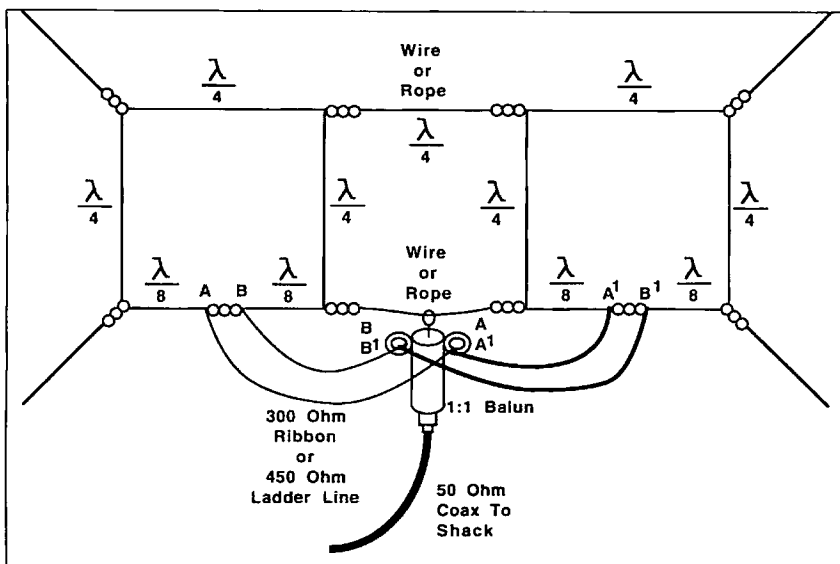


Figure 3. Construction of phased loops.

	$\lambda/4$	$\lambda/8$	300 Ω Ribbon	450 Ω Ladderline
40m	34.9 ft.	17.5 ft.	53.3 ft.	62.2 ft.
20m	17.6 ft.	8.8 ft.	27.0 ft.	31.2 ft.
17m	13.9 ft.	6.9 ft.	21.2 ft.	25.2 ft.
15m	11.8 ft.	5.9 ft.	18.1 ft.	21.97 ft.
10m	8.67 ft.	4.33 ft.	13.2 ft.	15.33 ft.

Table 1. Dimensions for the sections of the loops and phasing lines.

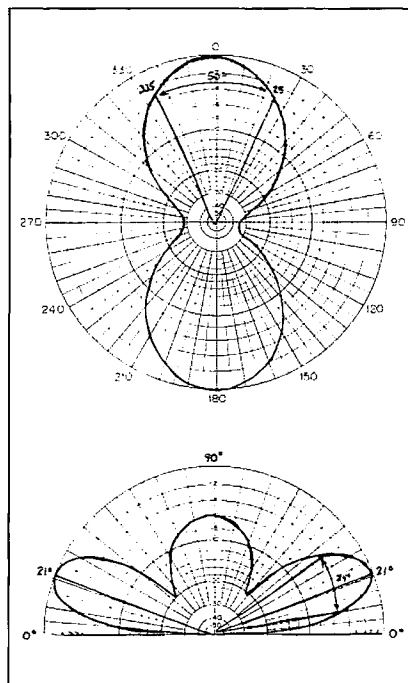


Figure 4. Radiation patterns. Max gain: 11.095 dBi @ 18.1 MHz (typical). Impedance (per loop): 133.404 + j0.040 (using W7EL ELNEC). Bandwidth: 50° -3dB, 65° to 115°.



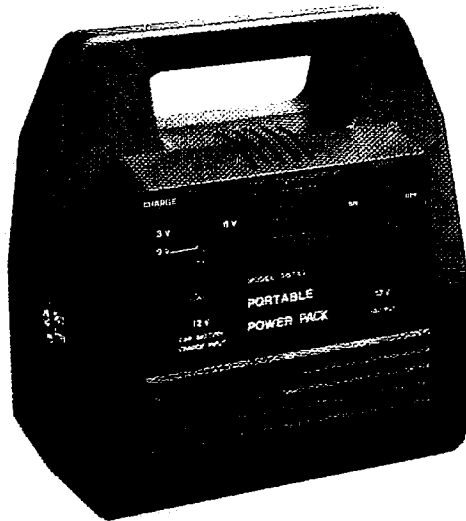
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Add Remote-Base Capability to ANY Repeater!

Bargain bells 'n' whistles.

by Klaus Spies WB9YBM

Home-brewed and low-budget repeaters share a common problem: lack of bells 'n' whistles. Here's an easy project that will give you remote-base capability while keeping your repeater home-brewed, and/or low-budget.

Having worked some "rooftop DX" with my HT at the local repeater site, I felt working DX on 10m FM would be enhanced if it could be worked from such a good site. That led to the development of the schematic shown in Figure 1.

When the squelch signal of the repeater receiver goes positive, both the repeater

transmitter's PTT and the remote base transmitter's PTT are enabled through U1A and U2A. Then U3A, through two electronic switches (U4A & B), disables both the squelch signal and audio of the remote base receiver to avoid feedback.

When the squelch signal of the remote base receiver goes positive, the PTT of the remote base transmitter is disabled through U2A and U3B, while enabling the repeater's transmitter through U1A.

Since the FCC requires that you listen to a frequency before transmitting, separate on and off functions are available for

both the transmit and receiver sections of the remote base. These on/off functions can be tied directly into whatever DTMF decoder is currently available on the repeater.

Squelch signals should already be present in the repeater. For this circuit (depending on the type transceiver used as remote base), signal conditioning may be required (see Reference 1). This can be done with a single IC. If a margin of safety is desired in the transmitter, a very simple time-out timer can also be added (see Reference 2), as can a "hang" timer

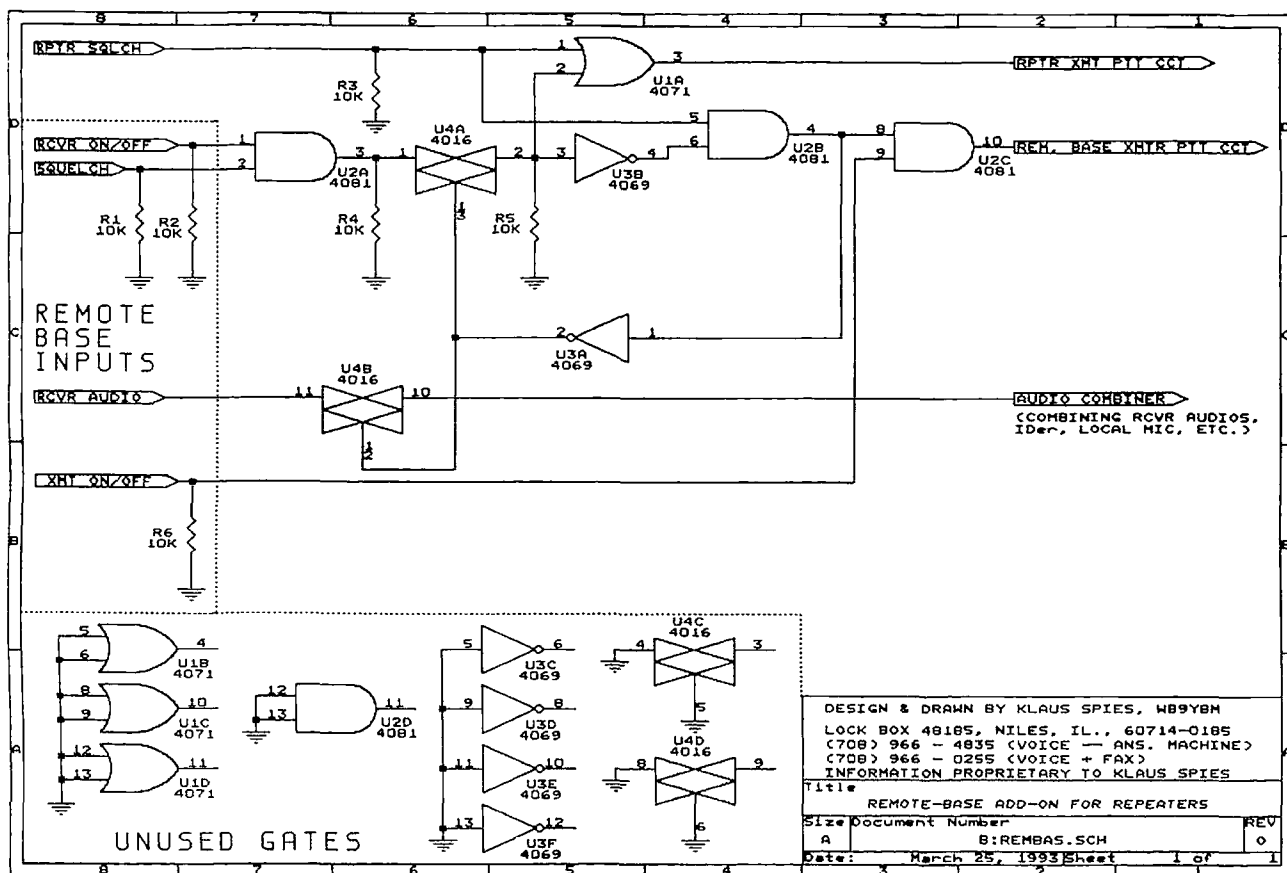


Figure 1. Schematic for remote-base add-on for repeaters.

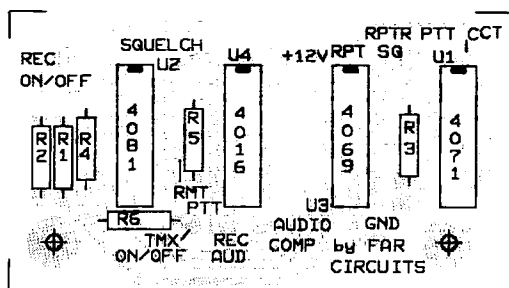
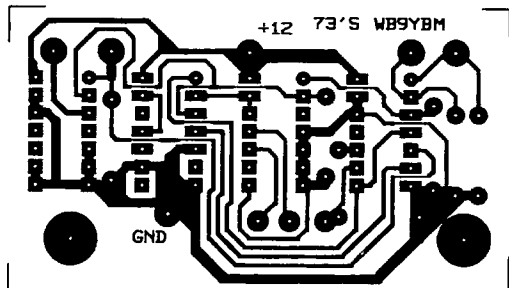


Figure 2. PC board pattern and parts placement diagram.

(see Reference 3).

Since a repeater and a remote base deal with high RF energy, circuit construction should have appropriate safeguards: by-passing on all input/output leads, as a minimum. If installed in the repeater cabinet inside a shielded control section, no other shielding should be necessary. If this isn't the case, install the circuit in a metal box connected to power supply ground. **73**

References:

1. "Midland 13-509 Modifications," *73 Amateur Radio*, pg. 27, December 1988.
2. PTT Time-Out, "Circuits," *73 Amateur Radio*, pg. 82, August 1990.
3. Ending Transmitter Chatter, "Circuits," *73 Amateur Radio Today*, pg. 27, February 1991.

Supply Connections

	+12V	Ground
4071	Pin 14	Pin 7
4081	Pin 14	Pin 7
4069	Pin 14	Pin 7
4016	Pin 14	Pin 7

Notes:

1. Pull-down resistors on control inputs ensure default modes are off, to avoid interference from the remote base.
2. All ICs are 14-pin packages.

Parts List

Item	Quantity	Reference	Part
1	6	R1, R2, R3,	
2	1	R4, R5, R6	10k
3	1	U1	4071
4	1	U2	4081
5	1	U3	4069
		U4	4016

Parts are available from Digi-Key Electronics, Thief River Falls MN.

Drilled and etched PC boards are available from FAR Circuits, 18N640 Field Ct., Dundee IL 60118, for \$4 plus \$1.50 S & H.

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DSP: The Whole Truth

*Everything you ever wanted to know about digital signal processing.**

**but were afraid to ask.*

by Ed Doubek N9RF

Designing Digital Processing into several police communication systems over the last few years produced some definite improvements in the quality of these systems. Applying the DSP principles to the reissuing of old recordings when they were released as compact discs has also helped to provide the quality the CD is noted for. This article will give you some insight into what the DSP systems can and cannot do, and will also suggest some low-cost modifications which can help to improve the quality of DSP-enhanced reception when used in amateur radio.

Digital Signal Processing seems to have taken the amateur radio community by storm. Many amateurs are not only asking how it works but how *well* it works. Manufacturers are rushing to provide this feature in new equipment so they can take advantage of this new-found miracle cure.

This article will give you a better insight into the working of a typical DSP system and will also provide a list of questions to ask yourself or a vendor when you are get-

ting ready to part with your hard-earned cash for a new station accessory.

Design of DSP Units

Figure 1 shows the hardware configuration of a typical Digital Signal Processing device. The hardware consists of an analog-to-digital converter that takes analog audio output of the receiver and converts it to a digital representation of the audio. The audio is processed in digital form and then converted back to an analog form with a digital-to-analog converter. It can then be amplified by a conventional audio amplifier and passed along to a speaker. After this processing, the final audio that is heard from the speaker can either be nearly identical to the original audio or it can be modified (corrected/improved) in the processing operation by removing unwanted distortion or noise from the audio signal. For narrow-band (communication) audio, a microprocessor operating at 30 to 40 MHz is typically used to enable several computations to be performed on each audio sample. The

typical sampling rate is at least two times the highest audio frequency to be processed. The NYQUIST rate is normally used since at this sampling rate the processor speed can be minimized and the distortion is minimal. The NYQUIST rate of sampling for a 3 kHz maximum transmitted audio frequency turns out to be 6 kHz.

In addition to the hardware, software is required to define the modification to be performed on the audio sample. The software is in fact the most variable part of the DSP system and causes the biggest variation in the DSP performance of the system. Normally one of two methods is used to program the processing. In the first case, an algorithm (formula) is used to process the signal and to generate the correction required to improve the audio. The second method is to look up the sampled audio in a table, then correct the audio based on what the table shows. In some cases, a combination of the two methods is used to correct the audio. Keep in mind that the more sophisticated the technique used, the more instructions per sample are required, and consequently the more expensive the software and the higher-speed hardware required to do the processing.

Features

Some DSP units are only suitable for eliminating heterodynes. Other units simply provide bandpass characteristics. The best systems employ an additional feature which provides a noise reduction mode as well as getting rid of white noise and pink noise. When purchasing a DSP unit, make sure the front panel gives you several modes of operation as well. If the mode switch provided is limited to just CW or SSB, it is probable the unit has either no noise reduction feature or one not adequately implemented.

Test Setup

Figure 2 shows the test arrangement that was used to determine what a DSP system can do to improve the quality of the audio and the intelligibility. This same test setup was also incorporated in a system to demonstrate the audio DSP technique to police departments. A cassette tape of good quality was mixed with a variable noise source to gradually reduce the intelligibility of the recording, then a comparison was made by switching in a JPS (NIR-10) DSP

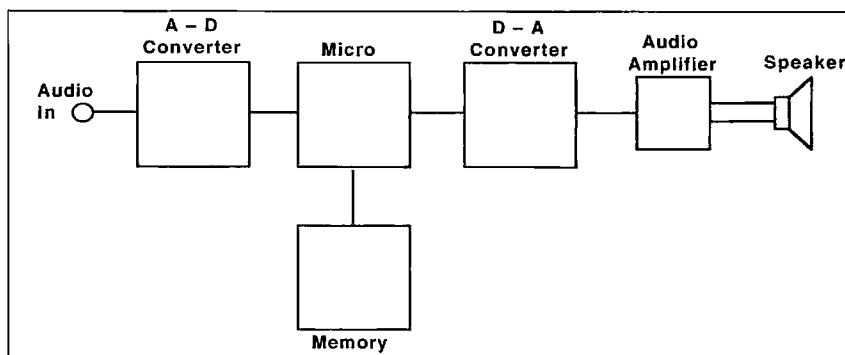


Figure 1. The hardware configuration of a typical Digital Signal Processing device.

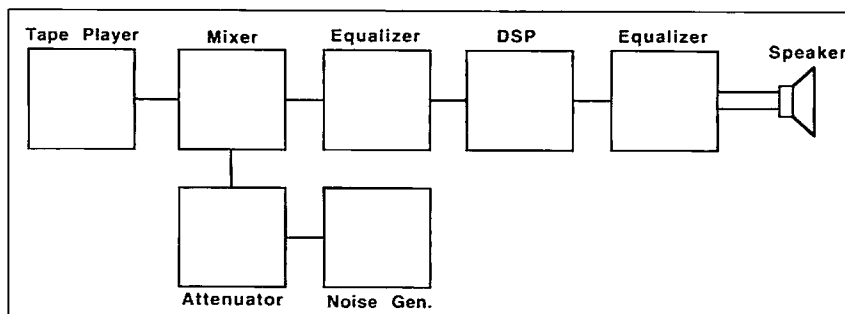


Figure 2. Test method.

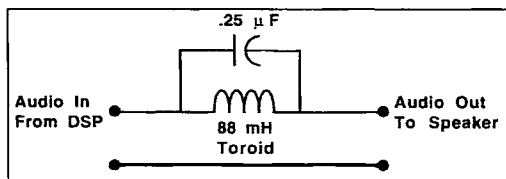


Figure 3. Minimal analog implementation.

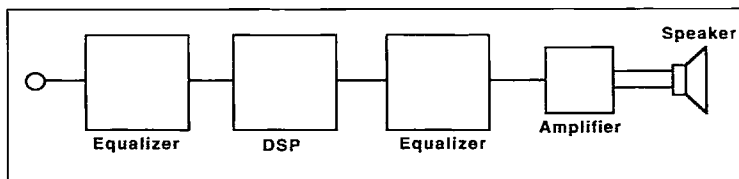


Figure 4. Note: Each equalizer is half of the stereo unit.

unit. When compared with the bandpass mode, the NIR (noise interference reduction) mode provides some rather dramatic results on voice signals. Improvements of between 6 to 10 dB have resulted, depending on the particular voice characteristic being processed. In most cases, a complete removal of all heterodynes is accomplished. The results in the noise reduction mode are not quite as good on CW because slow-speed CW looks like interference and gets completely removed. Above about 10 wpm CW can be processed with reasonable results. However, the bandpass filtering modes greatly improve the CW mode because of the nonexistent ringing. Normal CW filters in a receiver usually introduce ringing and other distortion when set to narrow passband.

DSP's most dramatic feature is its ability to completely eliminate (to the tune of 40 or more dB) any combination of constant or slowly-keyed heterodynes. In many units, a signal lasting for three ms or so in the NF mode is considered by the software to be a heterodyne and is removed. When in the NIR mode, a suddenly-appearing tone is removed after approximately 300 ms.

Can DSP Be Improved?

Yes, DSP can be improved. One of the problems that DSP exhibits is that as the amount of DSP action is increased, the amount of harmonic distortion of the lower frequencies being processed increases as well, resulting in a loss of intelligibility. When copying a heavily-accented voice signal, the DSP signal is even harder to understand. It has been shown that this distortion can be significantly removed by a change in the algorithm used by the processor, or by using an analog filter, as shown in Figure 3. Using a very sophisticated algorithm may require a faster microprocessor.

Another problem with DSP results from highly processed audio in the transmitter. Many non-DSP transmitter audio processors result in an increase in the harmonic distortion of the audio in the area of 1 kHz. This causes a loss of intelligibility at the receiver, especially when heavy DSP is applied to the received audio. In the case of heavily clipped FM audio resulting from some types of deviation control, the received audio may be almost impossible to understand when combined with an excited operator, a time of audio stress caused by an emergency, or when working a new country.

The Best Answer

In Figure 4, a dual-section seven-, 10- or

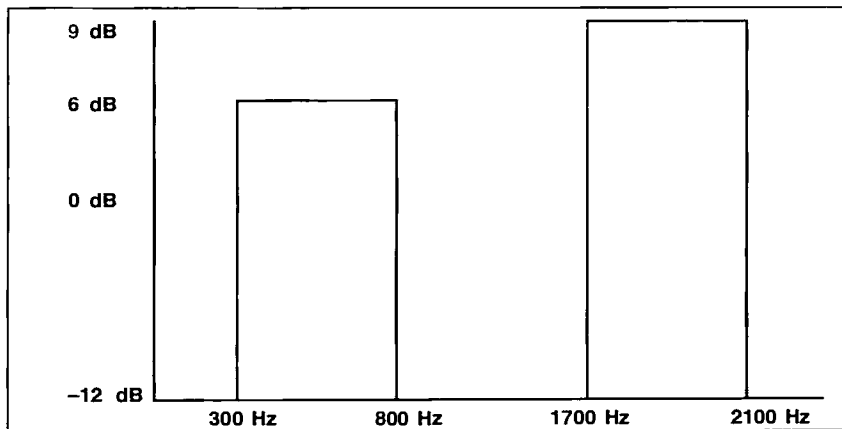


Figure 5. Equalizer curve.

15-band equalizer can be used to remove the audio response in the area of 800 to 1700 Hz. When one section of this filter is used to limit this band of frequencies ahead of the DSP unit and a second bandpass filter is used after the DSP unit, the improvement is dramatic and can almost double the effectiveness of the DSP system. When using this dual-band equalization, much of the distortion generated in the transmitter audio processor and received noise never enters the DSP unit and is never processed.

The second section of the equalizer is placed after the DSP unit and helps to improve the intelligibility of the processed audio. With this equalization, it has been shown that the audio can be intelligible with an increase of 3 to 6 dB of interference. A second benefit of this combination improves the intelligibility, even when using little DSP but while copying heavily compressed signals. For most receivers, cutting the spectrum below 300 Hz by at least 12 dB and the spectrum above 2.1 kHz by the same 12 dB removes all non-intelligence-bearing spectrum. The frequency range from 300 to 800 Hz should be boosted by 6 dB and the spectrum above 1700 Hz boosted by at least 9 dB.

Even though the audio processing improvements discovered by NASA use different response frequencies than those used in these experiments, the results are similar because of the overall receiver passband dissimilarities.

DSP in the Transmitter

Experimentation using DSP on transmitting has shown little improvement in experiments when the standard bandpass characteristic is used in the DSP units. When the

dual-band audio processing curve is used at both ends of the path, DSP does come into its own. An additional 3 to 6 dB of improvement results from this dual DSP implementation by packing the intelligence into two narrow bands rather than one wide band and further improves the intelligibility. This system is like using a 1.6 kHz filter in an SSB receiver without encountering the distortion the narrow filter generates.

DSP at IF Frequencies

If extremely high-speed microprocessors were available, DSP could be feasible in an amateur receiver IF. Because of availability and cost, this type of hardware would be impractical for amateur radio with today's state-of-the-art capabilities. Some pseudo DSP HF units have been implemented with prototype hardware, but they are not practical at this time. With DSP at IF frequencies, this filtering could theoretically place the receiver filtering much closer to the antenna, where it belongs.

Summary

Even without the DSP unit, the equalization curve shown in Figure 5 can be used after a receiver. These seven-band equalizer units are available for \$60 new, or can be obtained at many hamfests for \$15 to \$20. The more versatile 10- or 15-band equalizers make the implementation of this audio curve more accurate. Whether or not you are using DSP, the addition of audio correction to the audio output of your receiver can improve weak signal work, especially on 160 and 80 meters and VHF and UHF DX-ing.

Don't throw away your antenna just yet . . . DSP is good, but it has to have some signal to work on.

Recycled TV Beam to 2 Meters for \$2

Use an old TV antenna for this inexpensive, two-hour project.

by Marty Gammel KAØNAN

Last spring I was asked to supply a 2-meter beam for our local radio club's Field Day satellite contacts. Not having an extra beam, I found an old TV antenna someone had given me. There were many elements and the square boom was 92" long, perfect for the 11 dB gain needed.

Construction

First, I had to clean the boom of all elements and hardware. To do this, I used an electric drill to remove the rivets. Then I used a Scotch-Brite pad to clean any rust or

corrosion from the now empty boom and the removed aluminum elements.

I looked in a few antenna books for dimensions, settling on closely-spaced dimensions based on the NBS standard yagi design. There are many good books for finding workable spacing and element lengths. Using the *ARRL Antenna Handbook*, I developed the dimensions in Table 1 after reworking the spacing guidelines to come up with a seven-element beam that could be used in either vertical or horizontal polarization.

These measurements and spacing should give, in theory, over 11 dB gain, with a front-to-back ratio of 20-25 dB and good side rejection. Bandwidth for 1.5 SWR edges goes from 144.5 MHz to 147.750 MHz with 1.01 SWR at 146.250 to 146.5 MHz. If the beam is to be dedicated to SSB operation only, increase element lengths by 3/16" per MHz to shift the center frequency of operation down toward the bottom of the band.

There should be enough material to make all the elements from the material that you

strip off the boom. With all the material I had left, all I had to do was start measuring, marking and cutting. Take great care to drill all the holes squarely. The elements may be mounted either all *on* the boom or all *through* the boom. Mounting the elements through the boom will make a stronger, long-lasting beam, with less chance of elements working loose in the wind. I used stainless steel screws for mounting all of the elements.

Matching

You will need to make a matching network for this yagi. I chose a gamma match made from a piece of 3/8" aluminum tubing 7" long with a piece of RG-8 coax 7.75" long. I used the regular RG-8 coax; if you use RG-8 poly-foam coax you may need to change the length of coax for the gamma match.

To duplicate my gamma match, find a rubber or plastic cap that fits tightly over the end of the gamma tube (see Photo C). Strip the outer jacket and shield from the RG-8

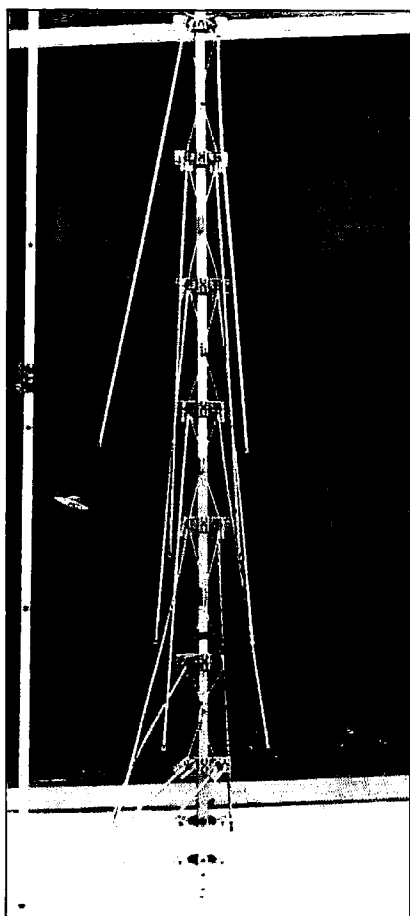


Photo A. The raw materials.

Table 1.	
Reflector length 40"	
Driven element length 38.125"	
1st director length 36.875"	Spacing to driven element 15.75"
2nd director length 36.75"	Spacing to 1st director 11"
3rd director length 36.25"	Spacing to 2nd director 15.25"
4th director length 35.875"	Spacing to 3rd director 15.25"
5th director length 35.675"	Spacing to 4th director 15.25"
	Spacing to 5th director 15.25"

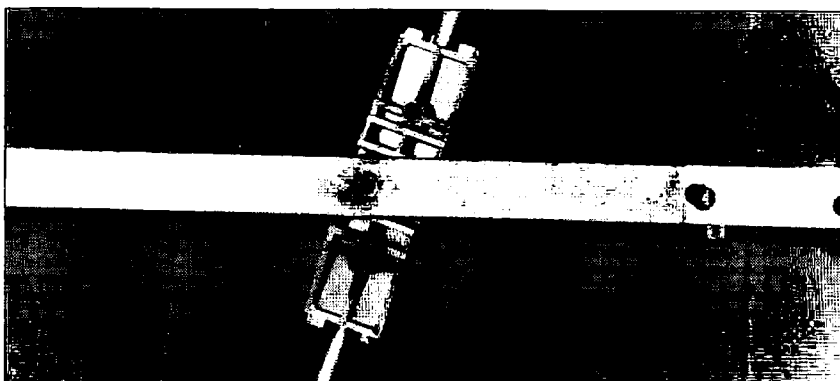


Photo B. Drilling out rivets to clean off the boom.

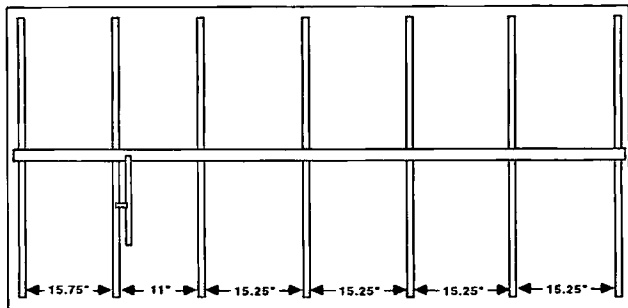


Figure 1. KAØNAN's 7-element 2 meter beam.

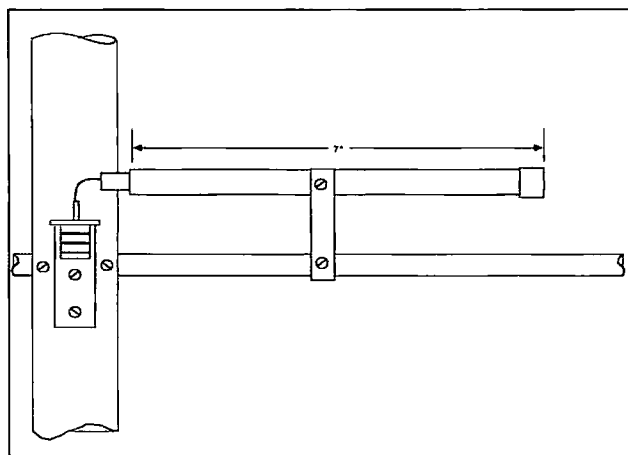


Figure 2. Gamma detail.

section of coax. Mount the center conductor and dielectric with a 1/2"-wide strip of aluminum or copper formed around the middle of the 3/8" tubing (see Photos C and D). Then mount an SO-239 panel mount connector to the boom with a piece of aluminum or copper perforated strapping. I was lucky enough to have some copper pipe hanger straps in my junk box to use for this.

Matching a gamma is fairly easy once you have the beam assembled. Mount the completed antenna on the mast about 7 to 8 feet above the ground. Set your radio to the center frequency that you designed for, place an SWR bridge between the radio and the antenna, then apply low power for your test transmission. Carefully note the SWR reading and slide the gamma in or out of the

Builder's Notes

A 1/4" drill bit should work well for drilling out the rivets holding the old elements to the boom. If you can get more than one old TV antenna to use as an element source, grab it—you can always use the extra materials for your next antenna project. When drilling the holes for elements, be sure that the elements fit snugly to help maintain squareness with the boom. You can cut the elements to length with a hacksaw, but file the rough-cut end smooth to ease the assembly of the beam. For the mounting screw holes I used a 1/16" drill bit; the screws should fit snugly.

Take your time when drilling and installing the elements to make sure that they are all centered and square to the boom.

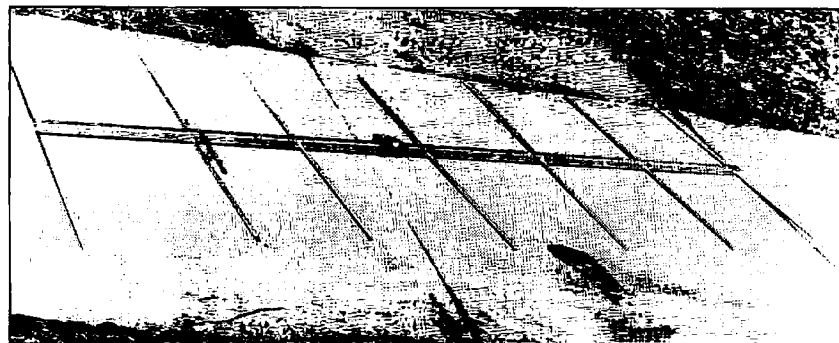


Photo E. The completed beam.

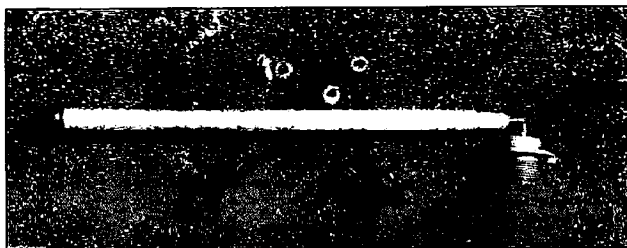


Photo C. Gamma parts.

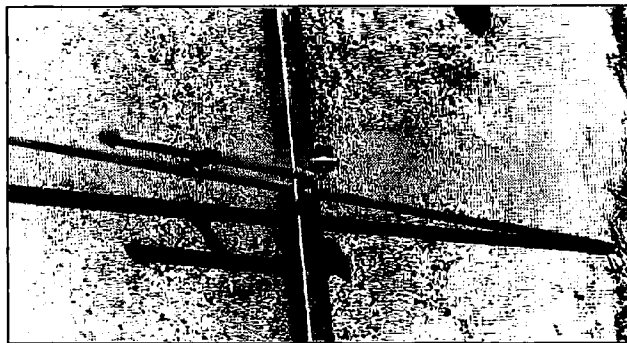


Photo D. View of the gamma.

gamma tube until you find the best match. Tighten the gamma to the driven element and you will be ready to install the antenna permanently.

Elements mounted out of alignment will distort the pattern and reduce the gain of the antenna.

Decide if you are going to mount the beam vertically or horizontally before drilling the element holes so that you can have the holes for clamping the boom to your mast in the proper plane. When the beam is to be vertical, you need to use a non-conducting mast to avoid detuning the beam and skewing the pattern.

I hope you enjoy using this beam and make many contacts with it. This project should take only a couple of hours from start to finish, once you have all the materials on hand.

Many thanks to John Berglund KØUBA for his help in editing this article.

Parts List

- Old TV antennas
- Electric drill or drill press
- 1/4" drill bit
- 1/16" drill bit
- Tape measure
- SO-239 panel mount fitting
- 1/2"-wide metal for gamma hanger
- Stainless steel screws (3/4" #4 self-tapping)
- RG-8 coax (short piece)
- Soldering iron
- Screwdriver
- Hacksaw
- Metal file
- Scotch-Brite pad
- 7" piece of 3/8" aluminum tubing
- Rubber or plastic cap for the gamma
- Marking pen or scribe (to mark measurements on metal)

A Discone Just For Fun

Fun to design, build and use.

by L. Scott Hall KAØDAQ

"What's wrong? Couldn't you make the last antenna work?" My wife always says this when I'm working on a new antenna. Putting up and taking down antennas is what I do in amateur radio. Anyway, that was a year ago last fall. It was a discone.

Does a discone sound high-tech? That's not how I made it, but it works.

First thing, when I decided on this project, I looked up what other people had to say about discones. Two references were found: *The ARRL Antenna Book* and *Home-Brew HF/VHF Handbook* by William Hood. I found Mr Hood's book to be particularly useful.

Defining the Project

A discone is a vertically polarized antenna with a disc (a capacitive hat 0.68 x the base width) on top and a cone a quarter wavelength at lowest frequency, from the vertex (the point at the top) to the edge of the base (an equilateral triangle from the side). The base is a quarter wave in diameter (see Figure 1). Mr Hood states that the disc should be spaced 6" from the cone vertex at 14 MHz (no formula was given). A discone should operate over a large frequency range. My plan was to use it on 10 and 15 meters. I took these numbers and plugged them into my pocket computer to run them a few times.

```
10: Input F
20: B=492/(2*F) or B=150/(2*F)
    for metric
30: D=0.68*B
40: Print B,D
50: Go to 10
```

Nothing fancy here—just the bare bones. Where F equals the lowest usable frequency. B equals base diameter and D equals the disc diameter.

The final design used 20.5 MHz as the lowest frequency because the SWR is supposed to rise rapidly at the lowest usable frequency. 20.5 MHz is a little below the 15 meter band, but I wanted the SWR to be low all the way to the bottom of the band. And it made the math easy. My final dimensions were 8'2" for the disc, 12' for the cone, and 4" for the spacing (I guessed for the spacing).

Before beginning I had to determine the number of radials to use. My reference book said one radial every 1/50 of a wave. That

would be 38 or 40 radials. I didn't believe this number, so I did some experimenting.

Modeling

I decided to build a model. The commercial FM band (88-108 MHz) often uses dual polarization. A discone should work on the vertical portion. A tin can about 4" in diameter was used for the vertex, with a hole in the remaining end for the coax, and 12 small holes punched around the open end to attach the cone radials. The coax is fed through the open end, then through the coax hole, with the braid pulled back 2" and soldered to the can. The 2" of insulated center conductor is fed through a 1" thick, 8" wide wooden disk. Two short screws hold the can to the disk. Any insulation on the coax above the wood

cut in the radials ends and crimped for a good mechanical connection.

After the top hat was up, I strung only two cone radials (stranded wire) from the can to start with (a stiff wire base loop was used to hold the radials in place). A small-diameter stick held to the vertex can by one screw was all the support needed. Hooking this up to an FM receiver with a signal strength meter, I was surprised to find it bidirectional. Adding a third was better. After six radials, gain was not noticeable on my equipment. I guess 1/50th of a wave for radial spacing meant without a base wire.

Since I planned on using a base wire to tie all the radials together, I decided on 15 radials per wave, or 12 for this antenna. I chose 12 radials for a better SWR on 10 and for lots of capture area.

Mounting Problems

The cone and disc for the full-size discone are very much like the test model's: a circle of plywood holding six elements, with the far ends shorted together to form the disc and 12 stranded copper wires hanging from a tin can and attached at the bottom to the base loop. The real problem is the supporting hardware. Holding up a tiny model is a lot easier than a disc over 8' across. The parts for this antenna sat around a long time before I finally came up with something I thought would work.

I always knew I'd use a 1-1/2" steel mast for supporting the antenna, but how could I attach it without any possibility of shorting out the cone and disc, yet still holding the disc 4" above the cone?

Mounting Solutions

The mount (spacers) consists of three pieces of 2x4 and a 5" circle of plywood (the 2x4s are 15", 8" and 3-1/2" long). First the 15" and 8" 2x4's were glued together (I used a hot glue gun) with their centers aligned (see Figure 3). A 1/2" hole drilled down the center gave me room to feed the coax through.

I heated up the glue gun again and stuck these two, the large end, to the bottom of the disc. I made sure that the hole in the disc and the spacers were lined up right. The can already had 12 holes punched in it for the radials and the coax hole in the remaining end. After slipping the coax through the hole I stripped off 5" of insulation, then bent

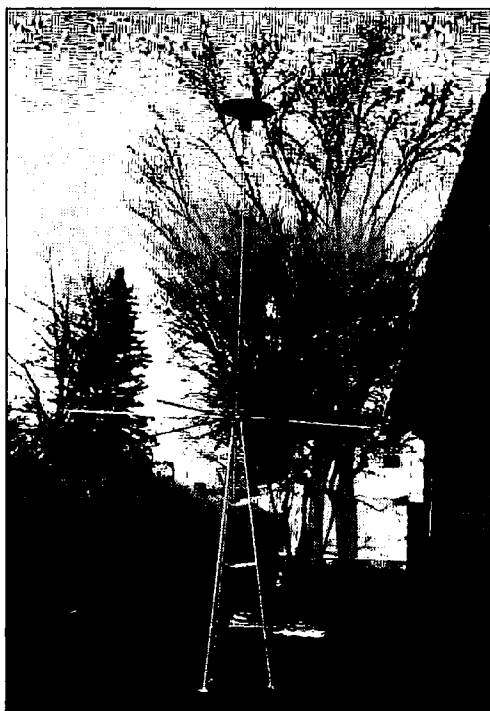


Photo A. The discone.

is stripped off. I poked a hole in the center of the tin can lid (the one removed to empty the can) and soldered it to the center conductor on top of the disk. The disc radials (six broken TV antenna elements cut to 11") were attached with screws, and the outside ends joined with a copper wire through a slit

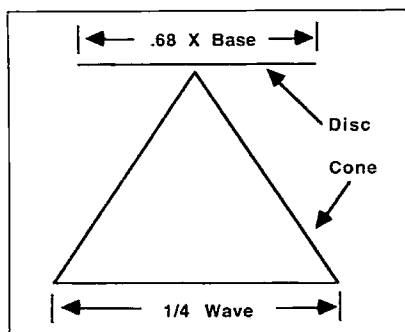


Figure 1. Discone measurements.

back and soldered the shield to the top of the can.

This is when I should have soldered the radials on to the can, but no, I did it the hard way. I slipped the center conductor through the center hole and, using more hot glue, pressed the can into place. I drilled a coax hole in the center of the 5" plywood circle and a mast hole in the 2x4 before gluing them together (see Figure 3). The plywood fit snugly into the can. And the mast, with the coax slipped through it, fit snugly into the 2x4 mast hole. This 2x4 collar keeps the mast from shifting. The plywood circle supports the weight of the whole antenna on the top of the mast.

Remember how on Field Day everyone puts up lightweight masts with guy lines? Now turn that picture upside down; that's how I hold the disc level. A guy line ring is mounted 3' down from the disc and four evenly-spaced ropes are tied from the edge of the 2' plywood disc to the guy ring (see Figure 2). This does a great job of holding

the disc steady.

A stiff wire simply wasn't going to hold 12 radials in place as on the model. I used a stranded wire for the base loop and six 6' sticks (1" x 1"). Two parallel holes were drilled in each stick, one through each end. While soldering the radials to the base loop, I slipped a stick on after every two radials. When all the radials and sticks were in place and the base wire was soldered together, I brought all six ends together around the mast and threaded a rope through the end holes. Then, taking up the slack, I pulled them all tight to the mast, like the spokes of a wheel, and tied them off level with the base loop.

Wrap Up

When I turned on the receiver the first

time I knew I had a winner, it worked great. Signals were coming in from everywhere. This antenna worked just like the books said it would: low SWR over a broad bandwidth, and a low angle of radiation for DX. At least this is true for the lowest 10 MHz I played with. Theory states the this discone should have a working bandwidth from 20.5 MHz to 205 MHz, but without VHF equipment I was unable to prove it.

My discone was fun to design, build and use. It had good receive and transmit qualities. I liked it, but it had some problems. Foremost, it pulls in signals from everywhere, not a good quality on crowded bands or in contests. With these qualities it might work well for a net control station, but not a good choice for your only antenna.

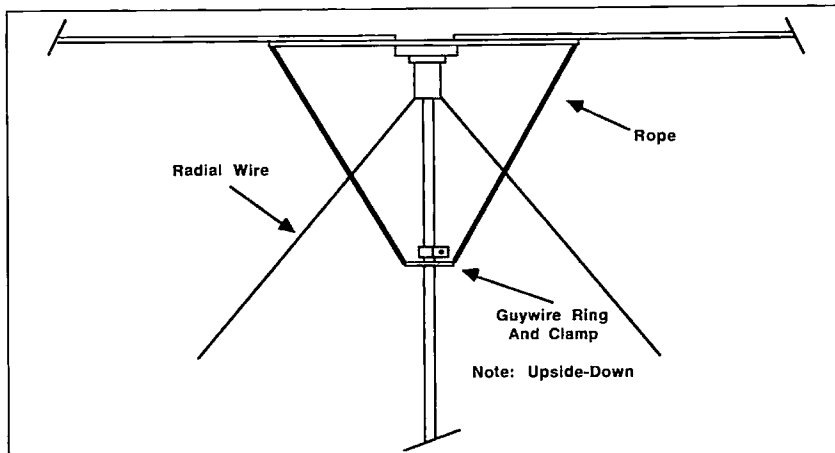


Figure 2. Guy ring mounting detail.

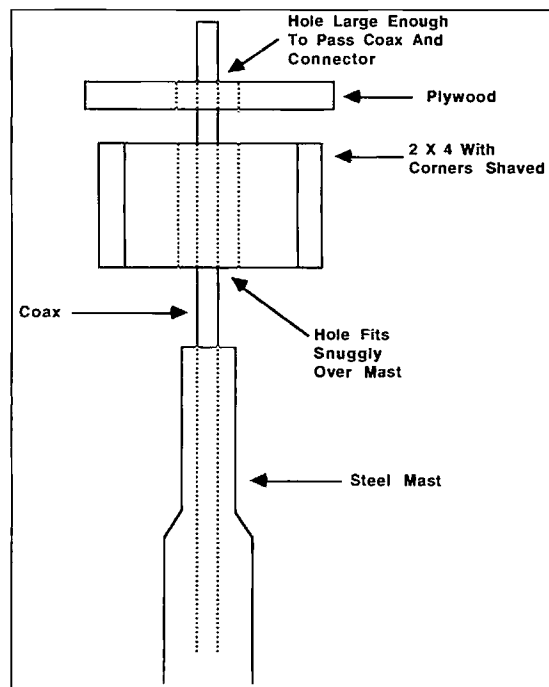


Figure 3. The 2 x 4 wood collar—plywood circle mounting detail.

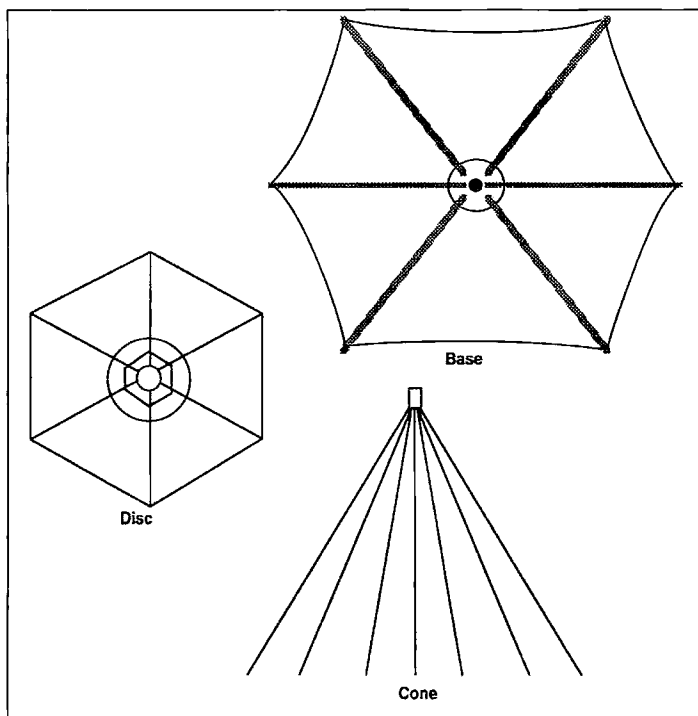


Figure 4. Base, disc, and cone detail.

by Larry R. Antonuk WB9RRT

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My first antenna was a 40 meter dipole, stretched between two pine trees in the back yard. The center insulator was a piece of Plexiglas. The unsupported coax hung down from the center of the antenna and draped across the telephone wires, eventually making it into my bedroom window. Not having much in the way of adult electronic supervision, I had simply stripped the coax back and soldered it to the wires at either side of the insulator. This worked pretty well, and gave me a low VSWR as well as a feeling of great pride. I began racking up contacts that were several states away! However, it wasn't long before my range started to decrease. I tested the antenna, and the VSWR was still quite low. I didn't have a real power meter, but the meter readings on my trusty ol' Drake 2NT were the same as always. It even lit up my dummy load (100 watt GE Soft-White) as bright as always, but my buddy could barely hear me across town. What was up?

It took a visit from an Elmer to point out the obvious problem. In my haste to erect the antenna I had simply soldered the coax to the wires at the insulator. I hadn't even looped the coax over the insulator for strain relief. Rain was collecting on the dipole elements, running downhill to the insulator, and filling my unprotected coax up to the brim. It only took a few showers before my cheap TV-store coax had a saturated dielectric, and was acting more like a dummy load than a transmission line. I had plenty of power going into the line at the transmitter, but none of it was making it out to the antenna. My 75 watts of crystal-controlled CW signal was simply heating up the coax. In retrospect, it seems that anyone with half a brain would never have had this problem in the first place. However, it did teach me that things electronic are seldom exactly what they seem, even if the tools you have tell you that everything is in order.

The Solution: A Field Strength Meter

There was only one tool that would have given me an indication of my problem, and that was something that would have measured the strength of the actual field being radiated from the dipole. Strangely

enough, the device is called a Field Strength Meter. (In actuality, the other method would have been to measure the power at the junction of the coax and the antenna. This method has been suggested in various texts, but I had a problem with it. For one thing, I didn't have a power meter. More importantly, I never figured out how to get up to the junction of the dipole when it's strung between

two trees with the feedline dangling straight down. My family didn't own a bucket truck. (This is another one of those things they just didn't explain in the *Handbook*.) In any event, had I taken a couple of reference readings with a field strength meter and jotted them into my log book, I would have had a pretty good idea of where the problem was. At least I would have understood that there was a real problem, and that I wasn't just losing my marbles.

A new entry in the field strength meter field is the DIGI-FIELD unit, produced by IC Engineering of Encino, California. The DIGI-FIELD is a self-contained battery-operated field strength meter in a 3" x 4.2" x 1.5" heavy-duty plastic box. The unit comes with a 3-1/2 digit LCD display, an SO-239 connector, and an output jack for monitoring the demodulated (AM) signal. The range of the meter is from DC to 12 GHz, which should cover most of your ham applications. (By the way, IC Engineering is happy to supply spec sheets and charts on request.)

The basic design of any field strength meter is fairly simple. An antenna feeds an RF signal to a diode rectifier. The rectified voltage is then filtered by a capacitor, and the resulting DC voltage is measured by a meter. This system has worked fairly well for years. The only problem with it is that it takes a fair amount of energy to produce enough force to deflect even the most sensitive meter movement. In other words, the standard field strength meter tends to be somewhat "deaf." Several schemes are available to increase the sensitivity of the units—some use tuned RF filter circuits that resonate at the desired frequency, some use broadband amplifiers, some use a simple transistor amplifier that follows the detector diode.

The DIGI-FIELD meter approaches the problem from another angle. It does away with the mechanical meter movement, replacing it with a solid-state LCD display. The input impedance of the digital meter is much higher than any mechanical meter, so less voltage is required to produce a usable reading at a given frequency. The result is a higher sensitivity meter with no front-end to tune. As an example, a standard tuned-RF



The DIGI-FIELD Field Strength Meter.

single-transistor field strength meter was compared to the DIGI-FIELD. Feeding a signal into the standard meter with a signal generator produced a "usable" needle deflection with an input signal of 500 mV at 146.000 MHz. The DIGI-FIELD meter produced a "usable" reading with only 80 mV. (Since the field strength meters compared had mechanical and digital meters that both read in relative, not absolute, units, this type of test may seem like "comparing apples to oranges." However, the minimum "usable" reading was that deemed to be useful during an antenna peaking operation, similar to tuning up a transmitter or perhaps foxhunting. This was actually about one-quarter scale on the mechanical meter, and about 1.0 units on the digital display.) This means the DIGI-FIELD is able to pick up weaker, more distant, or lower power signals.

So who needs a field strength meter? Well, if you've just picked up your first ham license you'll probably want to invest in one or two other instruments first—a good DVM, maybe a VSWR bridge. Then, if you find yourself drawn to antennas and antenna design, a good field strength meter is a necessity. The DIGI-FIELD can be used to plot the gain of various yagi antennas you might be building, or to compare one antenna to another. You can compare the effectiveness of various styles of antennas on your HT. Reference values can be taken on your HF antenna to make sure its performance is up to par. Around the shack, a field strength meter can let you sniff out bad coax connections or improperly grounded transmitters. As an educational tool, the DIGI-FIELD can be used to demonstrate the concept of gain, or antenna polarization.

Using the DIGI-FIELD

Operation of the DIGI-FIELD is quite straightforward—you turn it on and plug an antenna into the SO-239. RF measurements will appear on the display. Like most field strength meters, the readings are relative, and are normally used in a comparative manner. For example, to adjust the spacing on a yagi for maximum forward gain you might set up the antenna and meter a reasonable distance apart, and key the transmitter. Note the reading on the DIGI-FIELD, and make an adjustment to the antenna. Take another reading, adjust accordingly, and so on. The sensitivity of the meter can be adjusted by moving the telescoping antenna up and down, or by connecting a conventional antenna to the input jack. The DIGI-FIELD does lack a bar graph display, which would be handy in operations that are looking only for a peak, such as foxhunting. However, the LCD display does respond quickly enough to allow these types of jobs to be performed—just not as easily.

All in all, due to its high sensitivity and wide bandwidth, the IC Engineering DIGI-FIELD represents a reasonable investment, and antenna buffs will find it to be extremely useful.

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The Boyd Electronics RF Sweep Generator

Building and experimenting with RF circuits can be performed with a simple continuous wave (CW) signal generator, but the avid technician quickly learns that an RF sweep generator is a real asset on the bench. A sweep generator repetitively tunes through its set range of frequencies, thereby allowing you to examine the frequency response of the circuit under test on an oscilloscope. Circuits that test better on a sweep generator compared to a CW signal generator include:

- High-pass and low-pass filters
- Bandpass filters
- L-C tuning circuits
- Antenna tuners
- Crystal, ceramic or mechanical IF filters
- RF amplifiers
- Video amplifiers
- IF amplifiers

Sweep generators are used by service technicians to test and align radio

and TV equipment, and they are also used by engineers and technicians in laboratory settings. The service grade sweep signal generators may be cheaper than laboratory models, but they usually don't cover all frequencies that amateurs need. The lab models are in the multi-kilobuck price range, so they are out of the game as far as most hams are concerned. Perhaps the best alternative is to build your own sweep generator from a kit.

Last month, an advertisement by Boyd Electronics (1998 Southgate Way, Grants Pass OR; 503-476-9583) in 73 caught my eye. They offer the Model RSG-30 RF sweep generator as a kit at a very attractive price. So, I contacted Jerry Boyd, and he shipped an RSG-30 kit for review. (He also offers two assembled versions, but considering most hams would probably build the kit, I wanted to assemble this one myself. Besides, building stuff is one of the fun parts of doing this column.)

RSG-30 Features

The Boyd RSG-30 offers sweep from 2 to 30 MHz, and has the stan-

dard 50 ohm load needed for RF circuit testing. The output level is approximately 100 mV RMS, and sweep width is variable from 5 kHz to 30 MHz. A negative 12 volt, 20 ms trigger pulse is provided so the oscilloscope can be triggered in step with the sweep (which makes the presentation coherent).

Three modes are offered in the Boyd RSG-30: CW, Video and Symmetrical. The CW mode outputs a continuous, non-swept signal (Photo A) on

"The lab models are in the multi-kilobuck price range, so they are out of the game as far as most hams are concerned. Perhaps the best alternative is to build your own sweep generator from a kit."

a single frequency set by the front panel FREQUENCY control. It can be used in the same manner as any RF signal generator. The VIDEO mode is a swept

mode in which the RF frequency is swept from 2 to 30 MHz, while the SYMMETRICAL mode is a swept mode in which the width of the sweep (min to max frequency) is set by a SWEEP WIDTH control on the front panel (5 kHz to 30 MHz). Photo B shows the waveform on my oscilloscope when the SYMMETRICAL mode was selected and the SWEEP WIDTH was set close to maximum (so it is similar to the VIDEO mode).

RSG-30 Internal Circuitry

Figure 1 shows the block diagram of the Boyd RSG-30 circuitry. The RF signal is formed by mixing together two other signals: the output of a 50 MHz crystal oscillator, and a 52 to 80 MHz voltage tuned oscillator (VCO). A VCO is a circuit in which the RF frequency is set by a tuning voltage applied to a voltage variable capacitance diode (or "varicap"). The output of the mixer is the 2 to 30 MHz difference between the crystal oscillator (XO) and VCO signals, and this signal is filtered in a low-pass filter to remove the remaining components of the XO and VCO. The 2 to 30 MHz filtered signal is amplified by a Mini-Circuits MAR-1 MMIC amplifier. These amplifier ICs have a natural 50 ohm output.

The sweep and tuning voltage section contains a clock-driven sawtoothed generator, as well as DC offset circuitry for setting the center frequen-

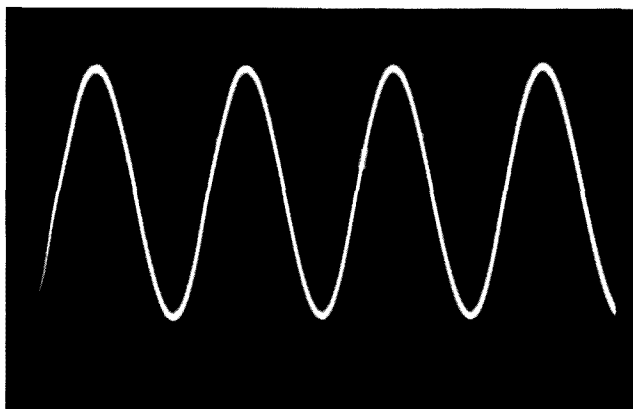


Photo A. Sine wave CW output of the RSG-30.

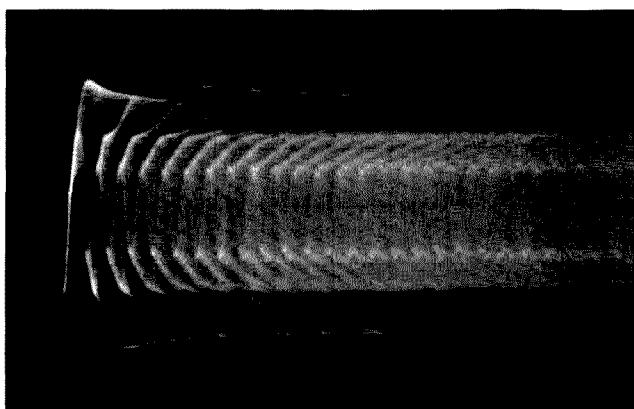


Photo B. Swept RF output of the RSG-30.

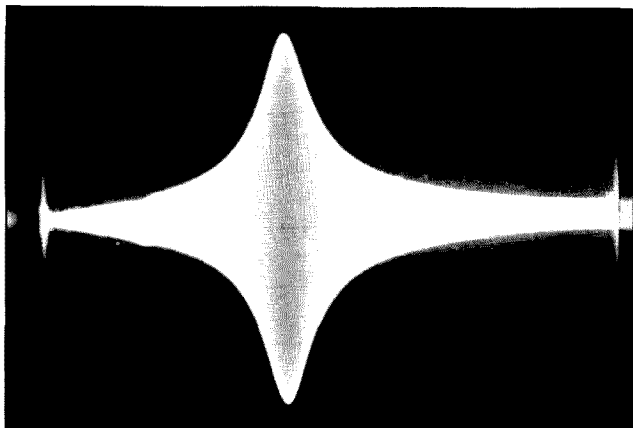


Photo C. Output of the circuit under test on oscilloscope screen.

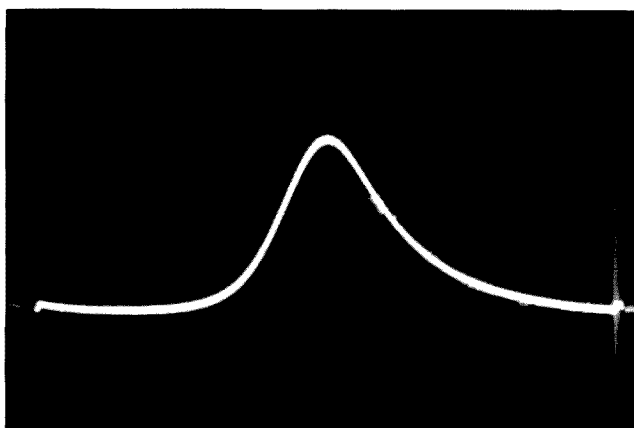


Photo D. Output of detector on oscilloscope screen.

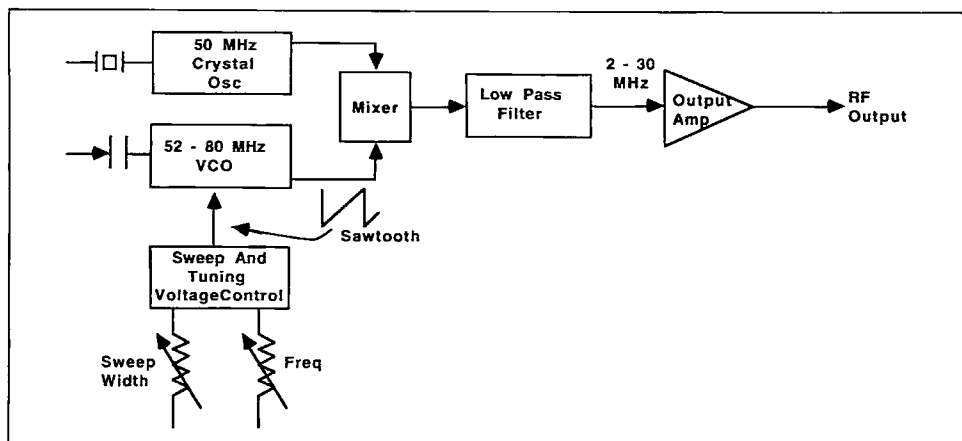


Figure 1. Block diagram of the RSG-30.

cy. The saw-toothed waveform allows the VCO to sweep linearly from a low to high frequency, and then snap back to the low frequency end of the swept spectrum. Both the sweep width and center frequency controls are part of the sweep circuit.

Using the RSG-30 RF Sweep Signal Generator

There are two basic ways to use the Boyd RSG-30 sweep signal generator. If you have an oscilloscope that has a 30 MHz (or greater) bandwidth, or if you can be satisfied limiting the RSG-30 to a lower bandwidth (say, 10 MHz), then the RSG-30 can be hooked up as in Figure 2. The SYNC connector on

the rear panel of the RSG-30 is connected to the EXTERNAL TRIGGER input on the oscilloscope. The RF output of the RSG-30 is fed to the input of the circuit under test (CUT). The output of the CUT is fed to the high frequency vertical input of the oscilloscope.

Photo C shows the waveform to expect when the RF is viewed directly. This particular trace was taken when the CUT was a 10.7 MHz IF transformer (the type used in FM broadcast receivers). A narrower filter would produce a similar trace, but with less width. In some cases, users prefer to lower the trace to the oscilloscope baseline so that only the top portion of the symmetrical waveform shows.

Many amateurs have oscilloscopes these days, but many of them are low frequency oscilloscopes found at ham-fests, government surplus, industry, or electronic repair shops. These oscilloscopes are not suitable for direct use with the RSG-30. If the hook-up of Figure 2 is broken at "X," however, we can insert a detector circuit. Some people use a demodulator probe for the oscilloscope, while others use the circuit of Figure 3. This circuit should be built inside a small shielded metal box. It consists of a diode detector (D1) and a filter capacitor (C2). The other capacitor is used for DC blocking to prevent any DC from the CUT from messing up the diode.

The diode used in Figure 3 is a germanium detector diode such as 1N34 or 1N60. These diodes are usually available at Radio Shack or at electronics parts places that sell Jim-Paks. Another source of the diodes is the service shop replacement lines of semiconductor such as NTE or ECG products. In those lines, the ECG-109 and NTE-109 are suitable.

Photo D shows the waveform to expect when using the diode detector. This waveform was taken from a 40 meter RF tuned circuit consisting of a disk ceramic capacitor and a 4.9 μ H toroidal inductor. The diode detector and filter removes the residual RF, and presents just the instantaneous DC output of the detector.

Boyd Electronics offers the RSG-30 in several ways. First, you can buy a kit consisting of the printed circuit board and all parts needed for the PCB board (RSG-30K). This costs \$59.95. They will also assemble and test this version for \$119 (order RSG-30A). For these options you will have to supply certain mechanical parts and the cabinet. Boyd Electronics gives you the Radio Shack part numbers. The company supplies a pair of adhesive templates that stick to the front and rear panels, and give the unit a real professional look. If you want the RSG-30 with a cabinet, then order RSG-30C for \$159.

Next month, we will take a look at some sweep generator applications, including a low frequency adapter for the RSG-30 that permits it to be used below 2 MHz.

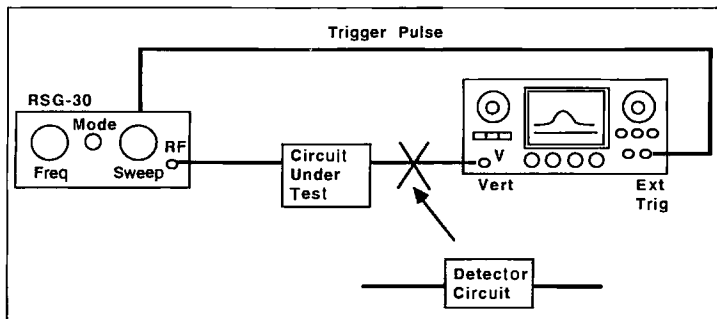


Figure 2. Normal set-up for the RSG-30 to test an RF circuit.

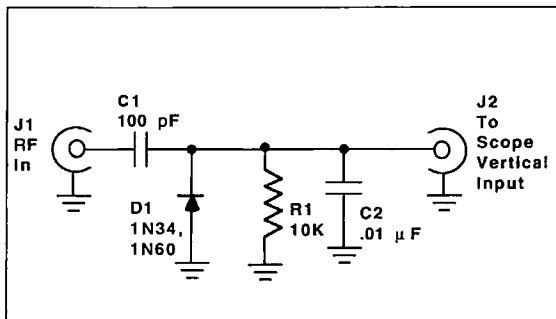


Figure 3. Simple detector circuit.

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At this time last year, AMSAT-OSCAR-13 was in perfect operating condition. The satellite was more than four years old and performing flawlessly. In recent months though, the situation has changed.

In May, the transmitter section of the "JL" mode transponder (23 cm or 2 meters up with 70 cm down) stopped working. All attempts to bring the 70 cm transmitter back on line failed. Studies of the satellite telemetry indicated that the exciter portion of the transmitter was functional but the power-amplifier section was not. This turn of events has placed greater emphasis on the popular mode "B" (70 cm up and 2 meters down) and more exotic mode "S" operation (70 cm up and 13 cm down).

Satellite controller James Miller G3RUH has reported that the 23 cm receiver still functions well and is being used for satellite control activity. G3RUH, DB2OS and VK5AGR have revised the 1993 and 1994 operating schedule without mode "JL" for A-O-13. It appears in Table 1. No further anomalies have been reported.

Field Day 1993

The loss of two modes via A-O-13 did not dampen satellite activity during Field Day in June. Passes over North America for both high and low orbit satellites were almost continuous for the 24-hour event. Many times, more than one active ham sat was above the horizon and available for contacts.

A-O-13 was excellent, especially during the morning hours of Sunday June 27th. Modest directional antennas provided many portable stations "armchair copy" when the satellite pointing angle favored their locations. While most stations focused on mode "B" operation, a few tried "S" reception on 2400 MHz with loop yagis, helix arrays and small dish antennas. The two-foot dish used at K5DX by our group did not work, but later investigation of the downconverter circuitry revealed some minor wiring errors. The two-footer (an old snow coaster) with a Down East Microwave converter (RR 1 Box 2310, Troy ME 04987; Tel: 207-948-3741, Fax: 207-948-5157, catalog available) can hear the satellite when properly connected and aligned. Steve KE5O heard several stations working mode "S" on Field Day, and worked one. His system included a surplus six-foot dish and a

patchwork downconverter with a 7 dB noise figure and no preamp.

Many other satellites were available for Field Day. Full-OSCAR-20 had been commanded to the analog mode (voice and CW) for the event. RS-10 was working well with mode "A" (2 meters up and 10 meters down). RS-12 was on, but the 15 meter uplink was overrun with terrestrial activity; the earth-bound operators were obviously unaware of their interference with satellite operators. AMSAT-OSCAR-21 was in the FM repeater mode using 70 cm up and 2 meters down.

The microsats were operational with 1200 bps PSK (phase-shift keying) on LUSAT-OSCAR-19 and AMSAT-OSCAR-16, and 9600 bps on UoSAT-OSCAR-22 and KITSAT-OSCAR-23. ARRL Field Day rules do not recognize contacts with the digital satellites, but the concurrent AMSAT Field Day rules encouraged uploading Field Day greeting messages and

downloading messages sent to the flying BBSs by other groups working the event.

Mir was in the sky and a few lucky folks managed contacts with the Shuttle Amateur Radio Experiment (SAREX) on STS-57. N5WQW operated some voice, and on some passes the W5RRR-1 robot was available for packet connects.

AMSAT Space Symposium

The eleventh annual AMSAT Space Symposium will be held from October 7-10, 1993, at the La Quinta Inn in Arlington, Texas. It will be hosted by the North Texas AMSAT Group and promises to be a great weekend.

Beginning on Thursday morning, October 7, at 9 a.m., those attending are invited to meet at the La Quinta Inn (State Highway 360 and Interstate 30) for a tour of various electronic surplus stores in the Dallas/Fort Worth



Photo A. Field Day 1993 at K5DX in central Texas. WA5ZIB repairing the 9600 bps TNC for U-O-22 and K-O-23 contacts.

A-O-13 Provisional Attitude Schedule 1993-4

Date	[Mon]	Alon	Alat	SA	to SA	Weeks	Notes
1993	Aug 09	180	-10	36	28	2	
1993	Aug 23	180	0	35	-33	9	
1993	Oct 25	210	0	-14	-36	3	<81% Moon eclipse Nov 13
1993	Nov 15	240	-5	-13	-35	11] Up to 137 minute eclipses
1994	Jan 31	180	0	-36	36	9] MA 110-144 Dec 07 - Dec 23
1994	Apr 04	210	0	19	38	3	
1994	Apr 25	230	0	21	33	11	
1994	Jul 11	180	0	36	-41	10	
1994	Sep 19	210	0	-25	-37	2	
1994	Oct 03	230	0	-20	-28	10] Up to 134 minute eclipses
1994	Dec 12	180	0	-41	—	—] MA 96-108 Oct 22 - Nov 06

Eclipses of Sun by Earth 1993/4 - Summary

Start	MA	Max	Mins	MA-MA	Stop	MA
1993 Dec 07	110	Dec 15	137	109-160	Dec 23	144
1994 Mar 22	254	May 23	23	251-004	Jul 20	001
1994 Oct 22	96	Oct 29	134	79-128	Nov 06	108

Eclipses of Sun by Moon 1993/4 - Summary

Date	Duration (Mins)	Obsc%	Orbit	MA-MA
1993 Nov 13	160	87	4148	172-209
1993 Dec 13	55	52	4211	74-94
1994 Dec 03	30	68	4855	12-23

A-O-13 Provisional Mode Schedules 1993

*** A-O-13 TRANSPONDER SCHEDULE *** 1993 Aug 09-Oct 25

Mode-B : MA 0 to MA 60 !
Mode-BS : MA 60 to MA 120 !
Mode-S : MA 120 to MA 145 !<- S transponder; B trsp. is OFF
Mode-S : MA 145 to MA 150 !<- S beacon only
Mode-BS : MA 150 to MA 210 ! Alon/Alat 180/0
Mode-B : MA 210 to MA 256 !
Omnis : MA 230 to MA 40 ! Move to attitude 210/0, Oct 25

*** A-O-13 TRANSPONDER SCHEDULE *** 1993 Oct 25-Nov 15

Mode-B : MA 0 to MA 130 !
Mode-BS : MA 130 to MA 180 !
Mode-S : MA 180 to MA 205 !<- S transponder; B trsp. is OFF
Mode-S : MA 205 to MA 210 !<- S beacon only
Mode-BS : MA 210 to MA 226 ! Alon/Alat 210/0
Omnis : MA 240 to MA 80 ! Move to attitude 240/0, Nov 15
Please don't uplink to B, MA 180-205. Interferes with Mode S.

*** A-O-13 TRANSPONDER SCHEDULE *** 1993 Nov 15-Jan 31

Mode-B : MA 0 to MA 220 !
Mode-S : MA 220 to MA 230 !<- S transponder; B trsp. is OFF
Mode-BS : MA 230 to MA 226 ! Alon/Alat 240/0
Omnis : MA 250 to MA 150 ! Move to attitude 180/0, Jan 31
Please don't uplink to B, MA 220-230. Interferes with mode S.

Table 1. Provisional event schedule for A-O-13 through 1993 and 1994.

area. Transportation and a guide will be provided.

Official registration begins Friday morning at the Inn. An antenna test range will be set up near the hotel for those wishing to test their favorite satellite antennas. The first of many line technical papers will be presented Friday afternoon in the La Quinta Conference Center. Friday evening is open for dinner with friends and family or a visit to the stadium next door for a Texas Rangers baseball game.

Saturday begins early with a full day of presentations and demonstrations. This is a great opportunity to find out what's new in the amateur satellite field. Topics include the Phase 3D satellite project, Pacsats, DSP modems, microwave communications and much more.

Saturday evening starts out with the traditional "altitude adjustment" hour followed by a banquet dinner with keynote speaker. Presentations and prize drawings follow 'til almost midnight. While dress is casual for the symposium, jeans are not suggested for the banquet.

For those who can stay, Sunday activities include a beginners' forum and other technical sessions. There is also the AMSAT Board of Directors' meeting in the afternoon.

Access to the area is easy. For those flying in to DFW airport, there is a free hotel shuttle to the La Quinta

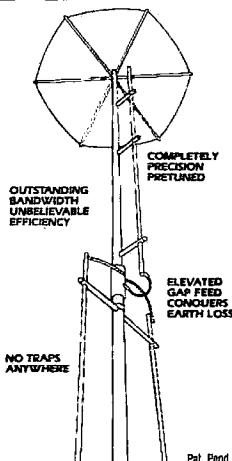
Inn. Call the La Quinta at 1-800-531-5900 to reserve your room before September 24th to get special rates of \$50 for a single, \$55 for a double or \$60 for a triple/quad. Suites are also available.

To preregister for the AMSAT Symposium, send \$15 for registration only, or \$35 for registration and the Saturday night banquet to: 1993 AMSAT Symposium, Route 1 Box 291, Waco TX 76712. Preregistration

is encouraged for those wishing to attend the banquet. This will be the third time the AMSAT Symposium has come to Texas and it promises to be one of the best. I'll see you in Arlington. **73**

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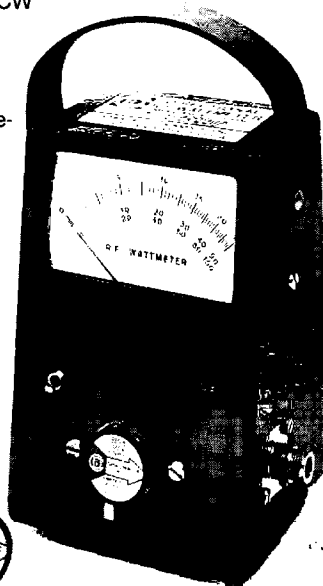
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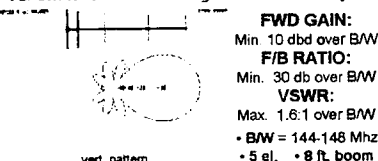
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Comments from the Survey

Yes, it took a long time, but I am finally getting a chance to compile the information from your survey responses. I am going to do this in two parts: This month I'll look at some of the comments and respond to them; next month (along with a special treat for those of you interested in TCP/IP), I'll give you the tabulated "statistics."

First, I really want to thank those who took the time to respond; your comments were thoughtful and helpful. I also want to thank those of you who made kind remarks about the column—a lot of what you said (perhaps without you even knowing it) gave me the impression that this column is a success. Though I can't please everyone, I want to provide you with information that is *useful* and *understandable*. You tell me I have been doing that. I even got a few suggestions on what I am doing wrong; I need those too. Please do not hesitate to let me know what you think. Just because the official survey may have ended doesn't mean that I want your input to end too! Write to me at the address at the top of the column or, much better, at my electronic mail address on the Internet: jsloman@bix.com. I really enjoy hearing from you on packet, too, but PLEASE—no business! I have had to ignore a couple of requests for things like reprint permission that have come that way. To contact me via packet use: N1EWO@N0ARY.#NO-CAL.CA.USA.NOAM.

OK, on to the comments. Many of you had very similar things to say, so I tried to pick representative examples. I wish I had the time and space to discuss every response—really, Bill N6XIV asks for "... more entry level plain talk ..." and is joined by Joel N2GOA who says, "KISS, for me, anyway." I am pretty sure that Joel is asking me to "Keep it Simple, Stupid" and not something that my wife needs to be jealous about. Other comments in this vein come from Bill N8NJA who asks that all ham radio writers keep this idea in mind, and Roger WD8DJR who laments the poor quality of some TNC manuals and asks manufacturers to "walk a new user through a complete setup." To those of you with these feelings, I will endeavor to provide you with the basic information you seek. I understand your frustration with the incorrect assumption made by many technical manual writers that everyone knows a lot more than they do. I struggle with this in all of my techni-

cal writing—being reminded doesn't hurt.

On the other end of the scale, Don KI5SS asks for articles on "advanced topics," listing data lists, block diagrams of multimode stations for satellite ops, and equipment lists for setting up those stations. I think you will find what you want, Don, in future issues. Steve N8AMW will also get what he asks for—technical info on PACTOR, an exciting new mode which is catching on like wildfire.

A lot of you, including Mitchell KC6SXY, asked for practically-oriented columns—something I like to do anyway. You'll be seeing lots of those. Mitchell also went on to give some good advice which he asked me to pass on: "Tell people they should *never* install a board into their computer without also carefully recording and attaching to the machine what they have installed and the settings. They should also immediately place the manuals in a cherished, preserved three-ring binder. Without these steps you may end up with a computer that is a total mystery to you." (I hope Mitchell doesn't mind the copy editing—my editors do it to me all the time.)

I agree with Mitchell on this one, and I have never discussed it here so thanks for bringing it up. The IBM-PC allows us the flexibility of inserting multiple adapter cards but, unfortunately, it has no way of automatically keeping track. Today there is a proliferation of communications and I/O (Input/Output) devices. The average computer user can insert these in his or her machine: scanners, fax boards, internal modems, internal TNCs, network cards, voice mail boards, and even more. The biggest problem is that all of these cards are competing for certain limited resources.

The IBM-PC has four types of resources that hardware adapters might want or need:

- IRQ (Interrupt ReQuest line or level)
- I/O port addresses
- Mapped memory addresses
- DMA channels (Direct Memory Access)

IRQ

The IBM-PC uses an *interrupt driven* architecture. What does that mean? It means that the designers of the PC decided to implement a system of hardware services that relies upon a request from the hardware device. How you service your hardware's needs is a basic problem of computer design. To make this a little clearer, let's take a look at a familiar example—the com port.

The PC com port is an asyn-

chronous device; that is, the data can appear at any time. Its flip side is the synchronous communications port, which is controlled by a standard clock on one end of the connection. With the PC's async port, timing is controlled by start and stop bits sent with the data. If you don't completely understand, don't worry—here's the bottom line: Since the Central Processing Unit or CPU (the computer equivalent to a brain) can't tell when the data is going to appear at the com port, it can do one of two things. It can keep checking the port over and over to see if anything is there, a process called *polling*. Or, as the PC does, it can wait for an interrupt request—sent by the com port when it gets data—and then service it. You can see now why it is called an "interrupt": It literally interrupts the CPU and asks for service.

On the PC the interrupts have various priority levels with "0" having the highest and higher numbers getting lower in priority. IRQ0, for example, is the timer interrupt—think of it as the computer's heartbeat. The AT version of the PC has 16 interrupts, though not all of these are available for your use. Some interrupts are reserved for the system.

As you can see from Table 1, IRQs 11, 12, 14, and 15 are "officially" available. The trouble is, you need a 16-bit card to use these! Why? An IRQ is a physical hardware connection to the bus. A 16-bit connector is needed to make those physical connections to the higher IRQs. Though it is changing, many cards still cannot use the higher interrupts.

What can you do? Fortunately, some of the "reserved" IRQ slots are rarely used by the hardware that is supposed to use them. For example, you can probably go ahead and use IRQs 5 and 7 without any ill effects. If you do not have a com port set for COM1 or COM2, you can use the associated interrupt. You can even "share" interrupts in some cases. This is risky business, though. First you have to find two boards that can get along with each other. This usually works best in the case of something like a scanner (image, not police!) that doesn't "wake up" until its special software is loaded. You can share the IRQ with another piece of equipment that is also well behaved AND WON'T BE NEEDED AT THE SAME TIME. In any other case, each adapter needs its own IRQ. So back to our original advice of writing stuff down: You need to know which IRQs are available when it is time to configure that new board.

I/O Port Addresses

Another resource, less scarce than the IRQs, is I/O port space. This is a memory space, distinct from RAM (Random Access Memory)—the place programs live while running—which is used to let hardware transfer data to programs. I/O ports are usually specified in terms of a

"base address"; this indicates where the I/O port begins in memory. Many adapters use I/O ports—sound cards, scanners, NICs (Network Interface Cards), and fancy display adapters are a few examples. Conflicts among cards for I/O space is not too common—but it does happen. Sound cards and scanner boards are often culprits. Most are flexible enough in where they can live that you will be able to find a spot that doesn't conflict. On the other hand, keep in mind that you may have two pieces of hardware that just don't get along!

Mapped Memory Addresses

Though it used to be uncommon, using mapped memory seems to be becoming more popular. This technique takes up a number of memory addresses in the 640K to 1024K range—(known as the Upper Memory Area or UMA) and *maps* the data to some memory that is physically resident on an adapter. This is much faster than I/O port techniques, and so you will find it on display adapters, NICs, and other applications which have to move a lot of data. The UMA space was set aside by PC designers for this purpose but was recently taken back to "load high" programs and the like. This is where a conflict might occur. In the context of our current discussion, write this stuff down with the rest of your information so you can tell if you've got a conflict between two adapters.

DMA Channels

The last of these resources are the DMA channels. DMA means Direct Memory Access, which is a technique to allow adapters to quickly access information stored in your RAM—without the assistance of the CPU. This is very important to some operations performed by scanners and other devices which have to move a lot of data in a hurry. On the AT there are seven DMA channels, but not all are available. This is usually not a source of conflict, but, if you have a sound board, you may do some juggling before you can install a second DMA-using board.

What Should You Write Down?

Make yourself a little chart with a line for each slot in your computer (you can't install more boards than slots!). Across your chart put the following headings:

- Manufacturer
- Model
- Serial Number
- Function
- IRQ
- I/O Port
- DMA Channel(s)
- Mapped Memory

Manufacturer is obvious: Who made the thing? Model and serial number are very important. When it comes time to get tech support help, this may just save you the time and frustration of opening your machine

Continued on page 51

RTTY LOOP

Number 17 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., W3AJR
6 Jenny Lane
Baltimore MD 21208

I thought I might take this month when the kids are going back to school to play professor, myself, and answer some of your questions.

We'll lead off this month with an Email message that arrived via America Online. Matthew Mucker KB5FWG says that he has two very beginner-level questions for me. As a college student on a budget, he has never exercised the privileges ham radio offers. He's been monitoring 144-148 MHz in Houston, though, and wants to get in on the action, but his budget, and good ol' ham radio spirit, has prompted him to try to build his own 2 meter radio. Looking through two or three current magazines, he has not found any which give detailed information. He is looking for references he could use to accomplish this task.

Second, while perusing the ads in the magazines (one would hope 73), he has read an article or two about packet radio. He's heard that packets are relayed all across the country. How does this work? He assumes that a station broadcasts the message

and a local repeater will pass it along. "How do I get started in this? It sounds a whole lot cheaper than calling long distance!"

Let's deal with the second question first. I'll try to simplify an overview of packet radio in just a few short sentences. Purists may quibble, but I'll try to be accurate. To begin with, the "packets" of packet radio are not messages themselves, but discrete bundles of characters which may contain several kilobytes of information. The contents of a transmission may therefore be made up of one or many such packets. Each packet carries with it an address, the intended recipient. Now, if you are sending to the recipient directly, there is no need to repeat the information. But, if not, the packet is received by an intermediate station, held in a buffer, and then retransmitted, to be picked up by the next station down the line. This might be the recipient, or another repeater. Unlike voice repeaters, however, which simultaneously retransmit received information on another frequency, digital repeaters, or digipeaters, receive and transmit on the same frequency. The transmissions take place only af-

ter listening to be sure the frequency is clear, and many transmitters may swap in and out with packets, all taking turns. Isn't that nice? And no, it may sound cheaper than long distance, but all that packet switching can take quite awhile, so it ain't faster. Additionally, remember, this is still a hobby, so no business messages via packet, not even to this columnist!

All you need to get started is a VHF transceiver (we'll discuss that in a minute), some kind of terminal, which can be a computer or dumb terminal, and a terminal node controller, the packet equivalent of a modem. These come in various styles and prices, from ultra-cheap to ultra-sophisticated. There are even computer programs which can substitute for the TNC; our "RTTY Loop" disk collection has a few worth looking at.

Two references I can recommend are: *Digital Communications With Amateur Radio*, which can be purchased at your local Radio Shack, or ordered as a special edition from AEA Inc., P.O. Box C-2160, Lynnwood WA 98036; and *The Digital Novice*, by Jim Grubbs K9EI, QSKY Publishing, P.O. Box 3042, Springfield IL 62708.

I don't have current pricing information on either book, but they are both good, and cover the material in different ways. Be sure to mention "RTTY Loop" to them when you write—maybe it'll get you something, maybe not!

Now, as to the other question, that of building your own 2 meter transceiver. Are you sure you want to do this? There are some kits available. One source that has been around for years is Hamtronics, Inc., 65 Moul Road, Hilton NY 14468. They have various transmitter and receiver boards in the hundred dollar and up (and up) category. You may do as well, and grow less gray hair, if you look into used equipment in your area. Ham clubs, hamfests, and just asking around may turn up a bargain. Even an old handheld might be all you need to get onto a digital mode. For all I know, two days after this column runs, every ham in Houston will be calling you to offer help. Just hold your solder for a few days, and let me know what happens, okay?

Shifting gears, as we often do in this "Loop": Matthew F. Judge dropped me this question via the CompuServe network. "I was reading your column in 73, and was hoping you could answer what may be a stupid question. I am writing a new computer-aided dispatch system for my police department. As such, I would like to put our TDD system in the PC. Is the RTTY Baudot code the same as the Telecommunications Device for the Deaf Baudot code? I have not been able to find any difference listed. If there is no difference, could you point me towards some RTTY Baudot software (must be in Windows)?"

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Well, the reason that you have not been able to find any difference between amateur Baudot and TDD Baudot is that there isn't any! After all, much of the early work in establishing the TDD standards was done by amateurs in groups like the Telephone Pioneers, working with discarded Model 15 and Model 19 teleprinters. The only major difference is that the tone pairs used in signaling on amateur AFSK and FSK circuits are different than TDD tones, which are based on telephone modem frequencies.

Any of the "TU-less" computer programs should work, as long as the proper interface to telco is provided. Again, there are several programs in the "RTTY Loop" collection you may be interested in. See the end of the column if you are interested in these materials, and good luck with this worthy endeavor.

Finally, something sentimental. Long-time readers of this column may remember my love affair some years back with the Motorola 6800 CPU. The father of the 6809, and grandfather of the 68000 series that powers Macintosh computers, this incredibly powerful computer never really took off. Well, here is a letter from John C. Delaive VE4YD of Winnipeg, Canada, who still has faith. He is running a system under OS-9, the multi-tasking, multi-threading operating system for

the 6800/6809 that predated OS/2 by a decade, with the original Stylo word processor, Dynacalc spreadsheet, and a RTTY program to boot! He offers assistance in locating boards or supplies for this system. Interested parties may drop me a line and I will forward the information to him directly. Thanks for the memory, John.

I have mentioned the "RTTY Loop" collections a few times. For those who came in late, I have four disks worth of programs, with collections #1, #2, and #4 being RTTY, packet, and amateur radio programs, and #3 the collection of archiving utilities. Each collection will fill a 3.5", 1.44 Mb disk, or appropriately more disks of lesser capacity. If you would like any or all of these collections, simply send me sufficient media (5.25" or 3.5") to hold the stuff (no need to format the disks), a self-addressed stamped mailer to return them to you, and \$2 in US funds for each disk enclosed. If you would just like a listing of all the programs, send a self-addressed stamped envelope to me and request the collection listing. Sure, I can send that to you via Email as well, on any of the usual networks. Send comments, questions, and critiques to me by mail at the above address, or on CompuServe at 75036.2501; America Online at MarcWA3AJR; or Delphi at MarcWA3AJR. I look forward to it! 73

PACKET & COMPUTERS

Continued from page 48

to get this info. Try to record the whole model number, and any revisions if you see them on the Printed Circuit Board or PCB. Record this information in the manual too, for easy access. Function means: What does the board do? Don't laugh, this may be necessary if you can't remember—and it happens! Finally, record the IRQ, I/O, DMA, and Mapped

Memory information so that when it comes time for a new board's configuration, you won't end up in a hair-pulling fit.

Next Month

We'll take a look at an interesting new product—using TCP/IP—that is a one-board (!) packet station. We're talking the whole station here, including radio. Talk about space saving. We'll also get a look at the "statistical" part of the survey information. 'Til then 73 de N1EWO. 73

IRQ0:	Timer
IRQ1:	Keyboard
IRQ2:	PIC (Programmable Interrupt Controller)
IRQ3:	COM2 and COM4
IRQ4:	COM1 and COM3
IRQ5:	LPT2
IRQ6:	Floppy Disk
IRQ7:	LPT1
IRQ8:	Real Time Clock
IRQ9:	Connected to IRQ2
IRQ10:	available
IRQ11:	available
IRQ12:	available (PS/2 mouse)
IRQ13:	Math CoProcessor
IRQ14:	Fixed Disk Drive
IRQ15:	available

Table 1. The PC-AT computer has 16 IRQs but some are used for the system. See the text for more.

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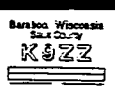
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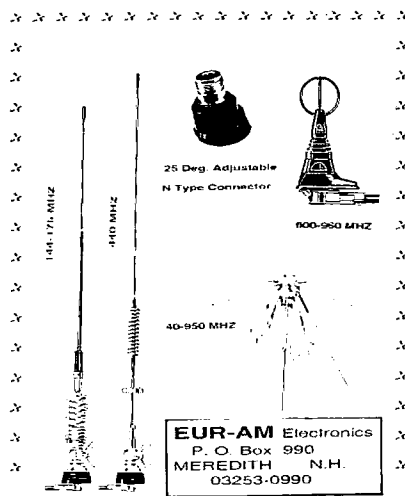
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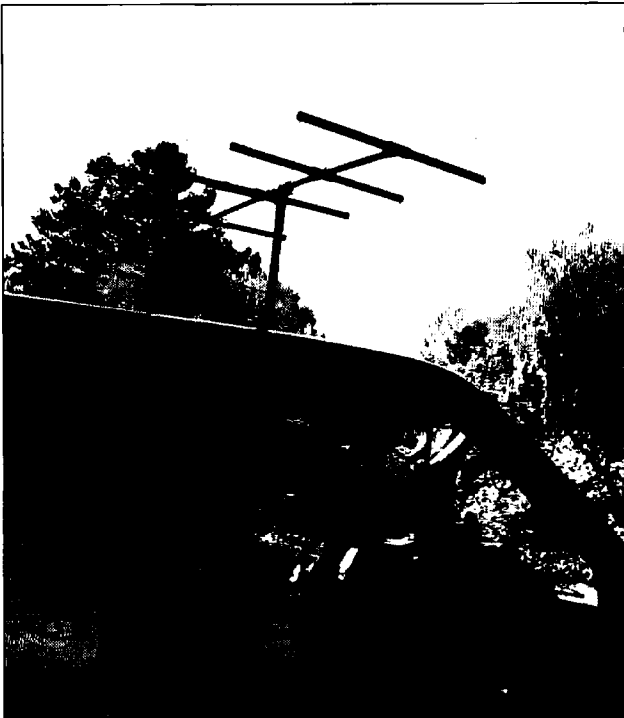


Photo B. 16-year-old Jason McLaughlin KD6ICZ loves everything about ham radio, but his favorite activity is T-hunting. Why not introduce a young person to ham radio by inviting him or her to ride with you on your next hunt?

outline together."

The best writing, whether fiction or nonfiction, is done by people with firsthand knowledge of their subjects. Dave is well prepared to write a book that includes data encryption, bicycling, and T-hunting. "Cryptography has been an interest of mine," he said. "I wouldn't really call it a hobby, but I am a member of the American Cryptogram Association. I guess it was my exposure to codes in the military that intrigued me."

Writers develop their own favorite ways of clearing their minds, forcing concentration, and releasing creativity. "At the time that I wrote *TFA*, I was an avid bicycle rider," says Casler. "I would go on a long bicycle ride and think through a chapter, then come home and write it down."

Casler drew on his T-hunting experiences at Brigham Young University to complete his tale of high school ham adventure. "I'd been interested in ham radio for years, but it wasn't until I was in college that I did something about it," he says. "The club I was in had a lot of T-hunts. We thoroughly enjoyed them. I thought they were the greatest thing."

"We'd gather together on Saturday for the hunts. They would be on 2 meter simplex. We'd limit ourselves geographically. They weren't like some of the modern T-hunts that are

truly grueling events. The fox had to stay stationary and didn't have to transmit a whole lot. Everybody constructed five-element beams out of the *Handbook* to hang out the side of the car and hold up on a stick. I didn't have one, so I'd be either the driver or the navigator on a team. We'd drive all over town and take bearings based on the S-meter. The first team to find it won."


Young readers will have no trouble identifying with lead character Ben Thompson. "I tried deliberately to make Ben a decent, fairly responsible, but in most respects ordinary person," says KEOOG. "He's vulnerable, not always as convenient as he could be. His buddy Josh Adams NOMUX is much the same."

Early in the story, Ben meets Toby, a new student from Los Angeles who seems hard to get to know. Ben wonders if he can be trusted. "Toby took over the book," Dave admits. "I hadn't intended for him to be that prominent. I became fascinated by this fellow." Readers will be, too.

"Stealth" Publisher?


The Tompkins and Wall books are readily available from ham radio dealers and by direct mail from the ARRL (see Photo A). Cindy Wall often goes to ham conventions and is invited to give talks in Oregon


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schools about ham radio and writing.

On the other hand, Casler's book is not being promoted by its publisher. You probably can't find it in ham stores. Fortunately, I noticed it in a 73 *Amateur Radio Today* ad for MFJ publications via mail order. You can order it by calling (800) 647-1800. Stock number is MFJ-3101.

When I asked if Ben Thompson might have more adventures in his future, Dave said, "Writing the book was a blast. I've thought about sequels. I've got two plots already worked out in my mind, using the same characters."

I hope MFJ soon realizes what an asset they have in KE0G and his book. It needs lots more publicity. I also hope that more elementary and secondary educators can be made aware of the value of ham radio fiction. All of the Tompkins, Wall, and Casler titles deserve prominent display in school libraries across the country. (Right, Carole?)

So if it's time to get a birthday present for a grandchild, niece, nephew, or any other young person who should learn more about ham radio, consider one or more of these fine books. But be sure to do your shopping early, so you'll have them in time to read yourself!

Next time a young person shows interest in your ham radio activities,

be sure to take time to give him or her some "show and tell." And when your club puts on a T-hunt, invite a youngster along (Photo B).

Tones for the Tiny T

Last month I reported that Ken Bauer KB6TTS was adding FM to his subminiature CW transmitter for 2 or 1-1/4 meters, described in May's "Homing In." Ken's modulator has

circuit (Point A).

The modulator circuit loads the oscillator, so order your crystal about 2 kHz higher than your intended output frequency. DC bias on D1, supplied by resistive divider R8/R9, fine-tunes the carrier frequency. Values given for these resistors are to be used as a starting point. Change them as necessary to put your T exactly on channel. As the

"Next time a young person shows interest in your ham radio activities, be sure to take time to give him or her some 'show and tell.'"

been successfully tested and it works perfectly with the Communications Specialists ID-8, reviewed last month. The entire hidden T, including the 9-volt battery, fits inside a small pill bottle or . . . well . . . use your imagination.

Figure 1 is the schematic for the added circuitry. D1 is a varactor diode, Motorola part number MM-BV809L. It changes capacitance as a function of the reverse voltage applied to it. This varies the frequency of the oscillator, resulting in FM. D1 connects through L4 to the crystal lead that was grounded in the original

battery voltage decays, some frequency change will occur, but it is not great enough to warrant a voltage regulator.

Most foxbox and IDer boards include keying circuits, so U1, Q3, R5, R6, R7, and C8 in the CW transmitter are not needed. Deleting them frees up about a third of the board space, giving plenty of places to tack down the modulator components. Connect the top side of R8 to the point marked Vcc on the original schematic. Vcc also ties to the positive battery terminal. The circuit ground of the tiny T goes to the NPN keying

transistor of your foxbox or IDer (gray lead of the ID-8).

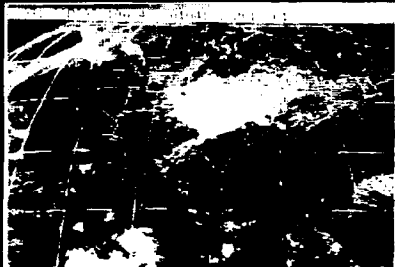
Surface mount components are best, although you can squeeze 1/8-watt resistors into some locations. Newark Electronics carries the varactor diode. All other parts are available from Digi-Key Corporation. Boards and completed units are available from KB6TTS. For prices and availability, send a self-addressed stamped envelope to Ken at 2306 Turquoise Circle, Chino Hills CA 91709.

In addition to the ID-8, suitable tone and ID sources featured in previous columns include RaCon (July 1993) and TBOX (October 1991). Approximately 2 volts peak-to-peak audio is required for +/- 4 kHz deviation. Foxboxes are designed to drive microphone inputs of HTs and mobile rigs, so they include one or more dropping resistors in series with the audio level potentiometer (R9 and R10 in TBOX, for instance). Short these resistors or replace them with lower values to raise the audio voltage output.

Set FM deviation with the audio pot on the tone/ID source. A deviation limiter circuit is not included because foxboxes have constant output level. However, you may need to add a high frequency rolloff capacitor across R9 to round off square wave foxbox tones.

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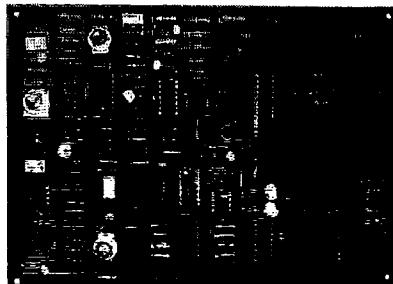
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Ocean Challenge Follow-Up

This column deals with one of the best follow-up activities we've ever had in our ham radio class. When my 6th, 7th, and 8th grade ham radio students were selected to get involved with the Ocean Challenge project ("Hams With Class," June 1993) we had no idea what a fantastic fun learning experience it was going to be.

Bill Biewenga and Rich Wilson WA1BZE set a new sailing record on April 7, 1993, from San Francisco to Boston, around legendary Cape Horn, aboard their 53-foot trimaran *Great American II*. Today in Boston, 69 days 19 hours out of San Francisco, the *Great American II* lies quietly between the New England Aquarium and Long Wharf, at a clipper ship terminal from the 1850s.

This incredible voyage was of special interest to us since my students were able to make actual contact with Rich via ham radio. The youngsters were positively mesmerized by his accounts of dolphin and whale sightings. You could hear a pin drop in our room as Rich described the flying fish that hit him in the face when he lowered himself overboard to remove some kelp from the hull. We were well organized by the second contact, with children at the wall map recording longitude and latitude readings, as the others stood by patiently with their prepared questions.

Rich explained to my kids that their dream was twofold: offshore, to challenge themselves in their chosen arena against the best; and onshore, to share their adventures en route with students and their families. As promised, it was arranged for Rich to meet with my ham radio students at the New York City South Street Seaport on June 10, 1993.

I am totally amazed at the amount of enthusiasm this trip generated in my school (Intermediate School 72 in Staten Island, New York). The 12 youngsters who actually contacted Rich were the first ones invited to meet him. I then ran several contests amongst my students to determine who else would be lucky enough to accompany us to the Seaport. The kids really went wild, bringing in all kinds of nautical and marine projects and reports.

On June 10th, 32 children and three parents accompanied me to meet with Rich Wilson in person. There was a canopy set up on board the *Peking* ship docked at Pier 17 in the Seaport in lower Manhattan. The weather was magnificent as we all proudly boarded the ship to have our much-anticipated live interview with someone who had just been a voice on the radio. The TV cameras were there, which added to the excitement.

The children sat on the deck in front of Rich as he enthusiastically conjured up the most wonderful images of his voyage for them. One child asked about the most beautiful sight Rich had seen. The response was that it was a hard choice, but that he had truly been



Photo A. Carole and the kids at the South Street Seaport in front of the *Peking*.

in awe at seeing a full double rainbow off the coast of Brazil. He also surprised the kids by telling them that he and Biewenga ate like pigs and kings in order to keep up their energy level. They consumed an average of 3,000 to 4,000 calories a day. They had lots of canned fruits and vegetables, and drank soy milk.

There were lots of questions about the relationship between the two crewmen. Rich explained that though they were best friends, they still had arguments. Living in a 12-foot-by-12-foot cabin, they learned to sacrifice their own egos for the team goal.

The children, of course, wanted to know about the scary things. Rich assured them that there were plenty of scary experiences. He said it both scared and fascinated him to think of the ocean beneath him being 13,000 feet deep. Many things amazed him, like the interconnection of things in na-

ture. Sand from the Sahara desert was found on their sails over 2,000 miles away.

The thing they both missed most was the contact with their families and friends. The first thing they did when they got back to Boston after their 15,300-mile voyage was to go out with family and friends for a big spaghetti dinner.

Of course, what made the children smile ear-to-ear was when Rich told them how very much it meant to him to speak with them on the ham radio. He said he took great heart in hearing firsthand how we were all rooting him on. His parting words to the kids at the Seaport were, "Keep dreaming your own dreams, and the day will come for you to go and live them."

There's no doubt that—thanks to ham radio—we were able to share in an extraordinary piece of history that we'll always remember.

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century starts a blowin', glaciers are cracking, bronchitic sea gulls are coughing up green ice cubes. The blizzard's so strong you're being lashed by unsecured penguins. Just when you can't take any more, a giant crevasse opens up before you. Suddenly, a yeti lays his paw on your shoulder as your left leg drops off from frostbite. At this moment,

don't you wish you'd brought along your HW-8 and a small antenna tuner? A random wire fastened to a stack of frozen penguins would be great while you pound away on your straight key for help inside your snow cave. Low power is always better than no power.

But what about the antenna tuner? You can't get too much inside a Cessna 150, so you had better make it a bantam-size tuner. But, you want one that will match coax as well as random wires and oh yes, don't forget about balanced lines, too.

Well, I may have exactly what you need. It's a Super Tee tuner designed

by D. A. "Mike" Michaels W3TS, and it first appeared in the June 1992 *QRP Quarterly*. Mike based his design on the original work done by DJ2LR, published in the December 1974 issue of *QST*.

Getting the Parts

The best part of all is that Kanga US has a complete kit ready to go. As with all the kits by Kanga, you get a baggie full of parts. Of course, the box to hold it in is up to you. Bill Kelsey was kind enough to let me have one of these kits at this year's Dayton Hamvention. The kit comes with all the inductors required, as well as several feet of wire of differ-

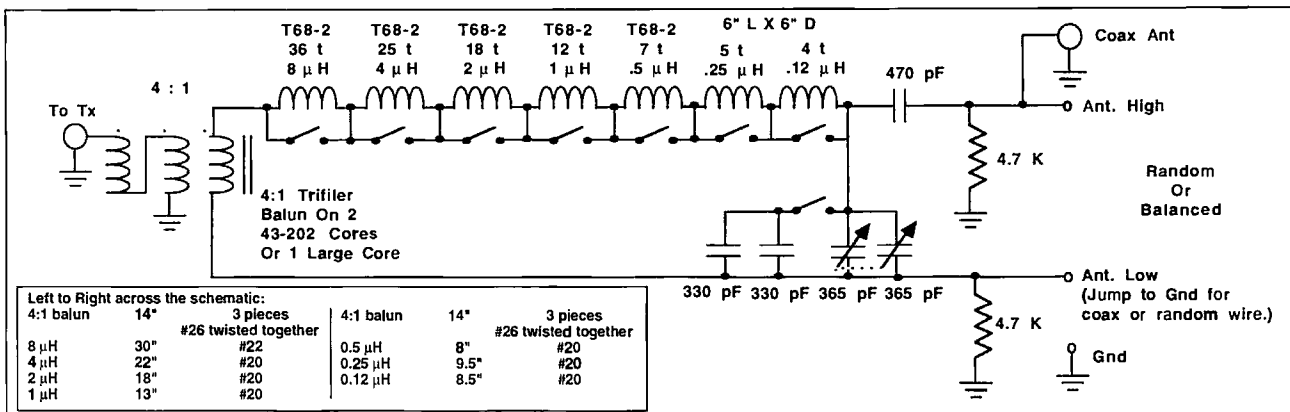
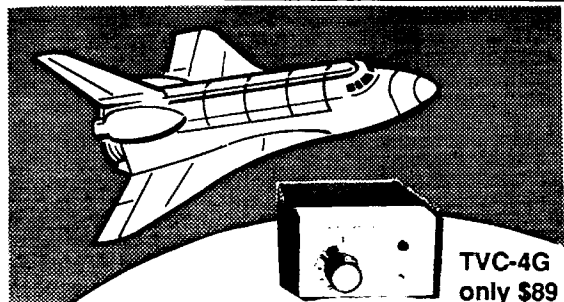


Figure 1. Schematic for the Super Tee antenna tuner.

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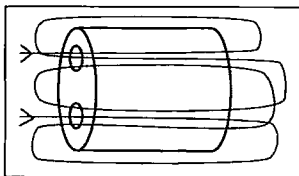


Figure 2. Winding for the trifilar balun. The solid line represents the three wires twisted together. Use an ohmmeter or continuity tester to be sure you have the right end of each winding when you solder it into the circuit.

ent gauge. Also included is the variable capacitor (always a hard-to-get part), and the two-hole balun cores, also hard-to-find. Even SO-239 antenna connectors come with the kit (surprise!). The Kanga Super Tee antenna tuner is \$20 plus \$3.50 shipping from Kanga US, Bill Kelsey, 3521 Spring Lake Drive, Findlay OH 45840.

How It Works

The tuner operates as a low-pass circuit and does not have any false modes that present high circulating current.

Seven slide switches and seven separate inductors are used to get a wide range of inductance while keeping the "Q" high. By using separate inductors that are shorted out by the switches when not needed, the shorted turn effect (which would lower the Q) is avoided.

ed. This means all of your hard-fought-for QRP RF is going to the antenna and not into the tuner.

One of the improvements Mike made is raising the low side of the tuner above ground. This allows the tuner to be used with a balanced line.

Putting It Together

As with just about all Kanga kits, the instructions are very thin. In fact, with this kit they're almost transparent! Even though this is not a hard-to-build kit, it might be more than the first-time builder can swallow. Not that the kit contains zillions of parts but, as with all antenna tuners, most of the work is metal forming and mechanical assembly. Without a ready-to-use box, the builder has to install seven slide switches, and that's not an easy task. Slide switches are a pain in the butt to mount on a panel.

There is no PC board to stuff. All the parts go in as point-to-point wiring. A pictorial would have really been nice to see, but alas, there is none. There is a large pictorial for winding one of the balun coils. This coil could be a source of real hair-pulling frustration without the drawing.

All of the coils mount to the back of the seven slide switches. You have to wind several toroids for this project, too. The instructions give information on winding the cores. There is a list showing you what length of what size wire to make each coil. Looking over the in-

structions, I came across some text telling me some of the coils come pre-wound but may have too many turns on them. So, just remove what you don't need and use the core. It would have been a good idea to mark what pre-wound core was what. I don't know about you, but I can't tell what the core type is by looking at it. Looking back, I wonder what would have happened if I just used the pre-wound cores without removing the extra turns? More inductance, yes; a screwed up Super Tee tuner, more than likely not.

The Variable Capacitor

The twin-ganged variable capacitor must be isolated from ground. How to do this is up to you. Several ideas are presented in the instructions to head you in the right direction. In the olden days, an insulated shaft coupling would be easy to come by; today, it's a different matter altogether.

I used a hunk of Teflon to mount my capacitor. Plastic stock would work just as well, as would a piece of sealed wood. A small length of a Bic Stick (the pen) makes a very good insulated shaft to connect to the capacitor. I happen to have a panel bearing in my junk box, so I did not have to worry about the case eating up the plastic shaft. An old pot (a 1957 version—not the ones used today) may be used for a panel bearing—sometimes. No matter how you do it, you must insulate the capacitor before

the tuner will work. That includes both the rotor and the stator!

On the Air with the Super Tee

All you have to do to operate this tuner is to select the proper combination of inductance and capacitance, just like a regular tuner. But, instead of flipping through a range of inductance via a multi-tapped switch or roller inductor, you have to flip the slide switches on and off, selecting or de-selecting the inductance.

You do this by fully meshing the variable capacitor (max capacitance) and leaving open the switch to the extra 660 pF. Next, adjust the slide switches for a noise peak in the receiver. Peak for best noise with the variable capacitor, keeping it toward maximum capacitance. Finally, apply RF to the tuner and adjust the inductance and capacitance for the best match. By going for the noise peak first you should be fairly close to the final adjustment.

I'm not sure about flipping the switches on and off with RF applied, even with QRP power levels involved. To be honest, I've never been one to trust slide switches to begin with.

All in all, the Super Tee antenna tuner works quite well. Depending on how you end up building it, you'll find room for one in your Cessna 150. Of course, it will be up to you to find out if you can even stack frozen penguins before you start running wires to the tuner.

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Inexpensive 900 MHz System

Last month we described the Fort Wayne, Indiana, crossband ATV repeater. In order to avoid many of the problems which can arise when building an in-band ATV repeater, the Fort Wayne group chose to put their output on the 900 MHz band. The 900 MHz band was chosen over the 1200 MHz band because inexpensive downconverters from a wireless video system called the Gemini Rabbit were readily available at many stores at a very reasonable

price (usually under \$50 for both a transmitter and a receiver, complete with cables, power supplies and an A/B switch). In fact, a number of stores sell just the receiver by itself at a substantial savings.

However, as with any bargain, there is a catch. These little black boxes (see Photo A) come with built-in whip antennas that need to be removed and replaced by connectors. Jim Pliett K9OMA of the Fort Wayne group would like to share some of his modifications that allow these units to perform well for amateur TV use.

Modifying the Rabbit

To add an antenna connector to the Rabbit receiver, you must first re-



Photo A. The Gemini Rabbit wireless video system consists of a tunable TV transmitter and receiver that operates on the 900 MHz band. (Photo by Jim Pliett K9OMA.)

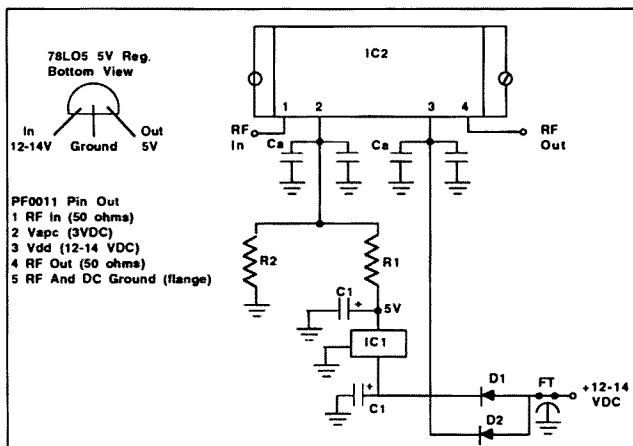


Figure 1. The output power of the Rabbit transmitter can be increased to over 5 watts through the addition of this Hitachi PF0011 linear hybrid MOSFET amplifier module. (Drawing courtesy of Bill Olson W3HQT of Down East Microwave.)



Photo B. To add an external connector to the receiver, remove the shield cover as shown. (Photo by Jim Pliett K9OMA.)

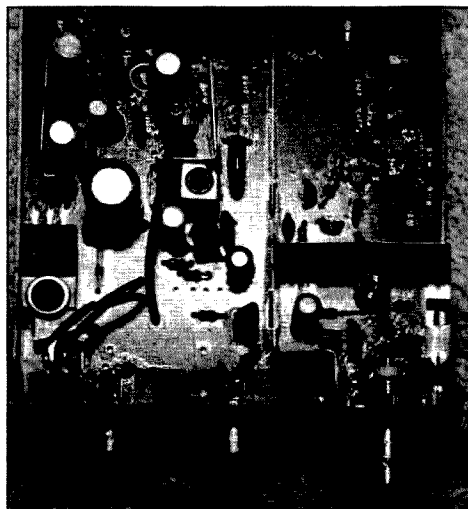


Photo C. Adding an external antenna connector to the transmitter. (Photo by Jim Pliett K9OMA.)

move the metal cover directly over the area where the whip antenna is located (see Photo B). You'll need a large soldering iron (100 watts or more) to remove this cover. You can also use a small pencil torch which can be obtained in most discount tool stores for around \$5 or so.

Once you have the cover off, unsolder the capacitor which is hooked to the whip antenna. Using a pair of pliers and a screwdriver, remove the two small screws and nuts holding the whip to the backplane. You will have to determine the type of connector you want to install on the back of the Rabbit's case (usually a female BNC or F-connector). In any case, try to find a connector that threads from the rear. It's much easier to install when you can insert the connector from the outside (with the nut on the inside).

Once the connector is installed,

just solder the capacitor to the connector's center pin, resolder the lid back on and you're ready to receive. Follow the same procedure to install a connector on the Rabbit transmitter (see Photo C).

Tune-Up

The receiver has a tuning control that covers most of the 900 MHz band. Once it's hooked up to an external antenna it appears quite sensitive when tuning in the ATV repeater. With the small size and shielding, it may even work well as an antenna-mounted downconverter if the tuning control lines are "remoted" (thereby eliminating most of the coax loss).

After you remove the lid of the transmitter unit you'll find a small potentiometer near the whip antenna. Adjustments to this pot will vary your output power from around -2 dBm to about +6 dBm (about 4 milliwatts). Although this is certainly not a real powerhouse, it does transmit an excellent quality picture and subcarrier audio. Since it is not crystal-controlled, it may drift in frequency somewhat, so try to readjust the transmitter frequency control whenever the drift becomes too much.

For those of you who want some real power on the 900 MHz band, there is an easy way to up the Rabbit's output to over 5 watts.

High-Power Rabbit

Bill Olson W3HQT of Down East Microwave offers a linear hybrid MOSFET amplifier module (902-928 MHz frequency range) that should take the low power (4 milliwatt) signal from the Rabbit transmitter and bring it up to over 5 watts (see Figure 1). In contrast to many power modules that were originally designed for the cellular telephone service, this Hitachi brick is very linear (perfect for AM-

modulated amateur TV). It runs off of 12 VDC and draws about 2.5 amps at full output power (approximately 10 watts) when driven with 10 milliwatts.

You should mount the Hitachi power module onto a heat sink (use a layer of thermal compound for efficient heat transfer). Be careful not to overtighten the mounting screws or you could crack the module's substrate. The output gain is adjustable from 30 to 50 dB with an external control voltage (3 volts nominal); however, the 30 dB gain setting offers the best linearity. Each of the two voltage inputs needs to be bypassed to ground through parallel capacitors, as shown in Figure 1.

Down East Microwave (Box 2310, RR1, Troy ME 04987; telephone: (207) 948-3741) offers the PF0011 module for \$65 + \$3.50 s/h, and a

blank PC board that can be used with the module for \$8. They also have a complete kit which includes the PC board and all components for \$95 (model #3310PAK).

This linear amplifier is easy to build and mates well with the power level of the Rabbit transmitter. It is also a good choice for any transmitter circuit you may want to amplify (as long as you don't exceed 10 milliwatts into the brick).

I hope that the easy availability of the units described in this column helps spur some more activity on the 900 MHz band. Even though we are sharing the band with an ever increasing quantity of consumer and commercial users, it's still a very effective band for ATV.

Thanks to Jim Pliett K9OMA and Bill Olson W3HQT for the information presented this month.

Parts List

IC1	78L05 +5V 200 mA 3 term. voltage regulator
IC2	Hitachi SC1043 hybrid module
C1	3.3 μ F 16V tantalum electrolytic
Ca	0.1 μ F and 0.001 μ F chip capacitors in parallel
R1	240 ohm 1/4W carbon film resistor
R2AA	470 ohm 1/4W carbon film resistor
FT	Feed-through cap
D1,D2	IN4004 diodes

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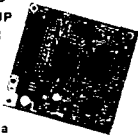
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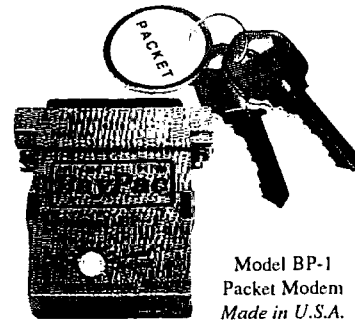
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10 GHz Operations Wideband FM and SSB

I have been asked numerous questions concerning 10 GHz operations, questions about everything from simple, easy-to-build systems to the more complex methods. The easiest to build and least expensive are the wideband FM systems. The least expensive types of these often use converted burglar intrusion alarms. At the other extreme are the SSB rigs that require expensive microwave hardware.

There are advantages to each mode. The primary difference depends on your luck finding equipment at a reasonable cost. In the case of the wideband, there are several outlets from which useful hardware can be obtained. These include many of the commercial burglar alarm companies that are replacing microwave units with newer devices. Check with your local alarm company to see if they will part with any of these gems

for little or nothing. They operate on 10.525 GHz, and can be moved down to 10.250 GHz by a simple screw adjustment.

If you are unable to locate surplus units, one alternative would be to buy from a vendor like SHF Microwave Supply, 7102 W 500 S. La Porte IN 46350. They stock both new and used units ranging in price from \$20 (for used) to \$65 (for new varactor-controlled units). These were not intended for communication purposes but they adapt quite nicely.

Varactor vs. Non-Varactor Systems

Having a varactor frequency control system is just like having a variable capacitor in the circuit for frequency adjustment. Usually, capacitance is adjusted by varying the control voltage from zero volts to +10 volts. (The Gunn diode is held constant at 10 volts). Diodes that work in this voltage range are best. They will give you about 60 MHz of frequency adjustment. This best case scenario is achieved using the very fine MA-COM GUNNPLEXER—the standard for excellence.

By comparison, the unit with varactor control available from SHF gives about 15 MHz of frequency control. The varactor makes the tuning operation quite easy compared to a non-varactor-controlled system.

In a non-varactor-controlled system, tuning is achieved by varying the frequency adjustment screw to the exact frequency you desire, just like with varactor units. You need to use a frequency meter or wavemeter. This adjustment is made with the Gunn voltage (normally +10 volts) set to about 9 volts. Then, after you have calibrated the set screw frequency adjustment, you can vary the Gunn voltage up and down from about 8 to 10 volts for a fine frequency adjust control. As the voltage nears 8 volts, some diodes will drop out of oscillation. This voltage limit varies among Gunn diodes. You will have to find the adjustment and voltage range to suit your system. The range depends on cavity adjustment and so many other factors that I simply can't list them all here.

Here's an easy method to remember: Find the lowest voltage your unit will work at reliably. Set the mechanical adjustment screw to approximately mid-range with respect to frequency difference. Remember, frequency is not always linear and may be more affected at one end of the voltage range than the other end. Usually frequency changes more at the high end of the

adjustment. I have observed about 5 MHz of adjustment using this method of voltage tuning on a typical 10 to 50 mW Gunn diode system.

The premium units to use are varactor-controlled systems, those with both a Gunn diode and a varactor diode in the oscillator cavity. They are the easiest units on which to set frequency—and they make wideband operation quite easy compared to the burglar alarm units. The key difference is cost, from about \$20 for a burglar alarm unit to something closer to \$250 for a MA-COM GUNNPLEXER cavity. For a cost somewhere in between you can home-brew a Gunn cavity with some brass waveguide and a lot of patience.

I have had Gunn diodes available for several years, including both 50 and 100 mW devices. The high power devices are finally all gone but a few 50 mW devices remain. I am still searching for a batch of varactors to facilitate new cavity construction. Varactors have been quite scarce on the surplus market, halting home construction projects in this area. Recently I obtained a small quantity of varactors and they did not test out to be wideband devices. I realized only about a 5 to 10 MHz frequency adjustment range—disappointing, but they worked. I will continue to keep my eye out for more suitable parts. I haven't spent too much time trying to pur-

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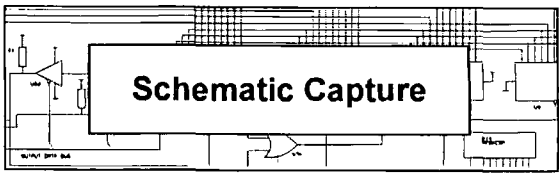
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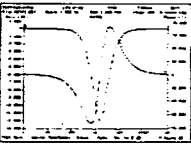
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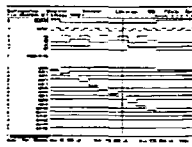
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Photo A. VHF and microwave station located on top of a 4,000 foot hill. Note the home-brew wooden dish used by N6XQ.

chase the components new, as I am trying to put together a "bargain basement" unit for wideband FM.

10 GHz SSB Operations

Operation on SSB—compared to wideband FM—demands a totally different type and complexity of circuitry. You could use these units for wideband FM but there is no reasonable benefit. The SSB systems will support narrowband FM just as easily as SSB and the improvements are remarkable, partly due to reduced bandwidth and frequency stability. Any time you

decrease the signal bandwidth you obtain a marked increase in distance and apparent power capabilities. For instance, take a 10 mW wideband unit and a 100 microwatt SSB system for comparison. On a path of about 150 miles during one of the the ARRL 10 GHz contests, we were unable to make contact with wideband FM using a 20 or so inch dish for the wideband FM system. With dish gain of about 25 to 30 dB, plus the 10 mW power input, we produced output power (ERP) of about 1 watt.

Now, for comparison, the SSB sys-

tem was a basic brick oscillator (with high frequency stability) and a mixer driven by a 2 meter FM handie-talkie for the IF system. This combination of components produced about 100 microwatts of power at 10 GHz. The antenna used was a 15 dB horn, and a reliable readable contact was easily made over this same 150-mile path. This narrowband system was operating at a fraction of comparative power output and some 15 dB difference in antenna gain, but the lower power and system gain still made the contact. The prime difference? Higher frequency stability was a factor, to be sure, but the most important factor was reducing the bandwidth from 75 kHz or so to 5 kHz deviation. A further improvement could have been made with SSB compared to narrowband FM, had SSB gear been available on this borrowed 10 GHz system.

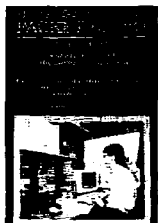
Improved SSB stations usually do not operate on that low a power level, but great results can occasionally be found. Higher power stations may include TWT amplifiers (10 watts power output) feeding a 30-inch dish with some 35 dB gain, making a very formidable system. Lower power stations with solid-state amplifiers like the ones discussed last month are also used for power output in the 1/4 to 2 watt range. A 1/4W amplifier conversion from surplus material was also discussed in this column in the

September 1992 issue of 73.

High power and frequency stability alone do not make a station—other equipment is required. Each added component adds to system cost. You need to add mixers, microwave relay switching, receiver low noise preamplifiers, and still package this in something other than a 50 caliber ammo can. (Although I still use ammo cans when I can find them.) Cost-wise, a typical 10 watt TWT amplifier in working condition is priced at about \$200. The mixers can cost upwards of several hundred dollars for new commercial jobs, but surplus units can be obtained for about \$50. The microwave relays of the SPDT variety (four required for full switching applications) cost about \$30 each. The receive low noise preamp costs about \$80 for a home-brew unit.

The local oscillator can usually be found in one of two forms. One is a home-brew, similar to one recently described in QST by Zac Lau. This unit consisted of a crystal oscillator multiplier that used several GaAsFETs for microwave multiplication to the required injection frequency. The other popular form of device is the famous "brick" oscillator that appears from time to time in surplus. Zac designed his home-brew unit because of the low availability of brick type oscillators. I have to admire his well-thought-out design. I haven't priced out his compo-

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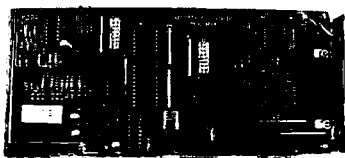
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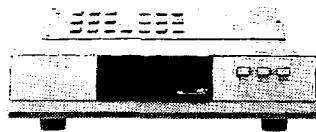
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nents, but I figure they cost around \$100, using a good junk box to hold cost down. That is competitive with the brick systems which cost \$50 each and require that an additional \$20 oven-controlled crystal be ordered from International Crystal for phase-lock operation. Again, this is just a price comparison of different systems.

The cost breakdown on the receive low noise preamp is as follows for a two-stage GaAsFET amplifier, with 18 dB gain and NF of about 2.5 dB: SMA coaxial connectors (female chassis mount) \$8, two MGF1402 FETs \$30, PC board w/chip res-caps \$20. Add some flashing copper for a box or container to house the amp and add the bias power supply and you add another \$10 to \$15 dollars to the amp's cost. Of course, this price can be greatly reduced by raiding a well-stocked junk box.

Well that's the overview on operation and system costs. There are many advantages and disadvantages to each and every system, not withstanding cost. These truths are not going to change. Narrowband operation methods far out-work wideband systems. Wideband systems are the least expensive. Crystal multiplier systems can have frequency accuracy problems, and that includes brick oscillators. But, if you can obtain a brick at a good price don't bother building your local oscillator. It's a lot easier to use a

brick than to build one.

Now, please be advised that I am biased towards the brick system and I use it extensively. I have invested lots of time in them and would rather fight than switch. Of course, what you do will depend on what you have available. I have acquired many extra bricks and will make them available to those interested, while supplies last. A 10 GHz brick is \$50 postpaid US only. A reset brick, set to 10.223 GHz for low injection (filters retuned), is \$65.

Please note that these units can be found at some surplus dealers for a lot less money. I have heard comments on prices ranging from \$100 at Dayton to \$5 from a flea market, so keep your eyes open.

Well, that's it for comparisons of different systems and components for 10 GHz. The basic mode of operation for most amateurs operating on this band is to first operate with wideband FM and then proceed to make many different modifications to their rigs, both commercial and home-brew. A natural transition to the more lucrative operation efficiency of narrowband modes is typical. During the last ARRL 10 GHz contest (September and October 1992), almost 90% of all 10 GHz contacts were made on SSB modes of operation. Wideband operation accounted for less than 10% of operation. Most of us bring out our wideband equipment but do not give it the same



Photo B. Bernardo XE2HWB at our hilltop operating position on the Isle De Guadalupe, Mexico.

attention that we used to. For instance, during the first contest back in 1986, all operation, without exception, was made using simple wideband FM burglar alarm units and some commercial MA-COM units.

Microwave Update '93

Just a reminder that the Microwave Update '93 Conference is going to be held September 24-25 in Atlanta. Papers to be presented at the conference include 10 GHz construction, waveguide fillers, 24 GHz operation, a single board 1296 transceiver, radio

astronomy, computer aided design, and microwave basics. This, as always, is expected to be a great program of microwave and VHF-UHF expertise. If you can go, you should. For details, contact conference chairman Jim Davey WA8NLC at 4664 Jefferson Township Place, Marietta GA 30066; (404) 998-6971.

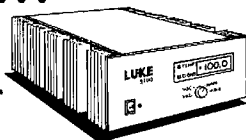
Recent Activities

One of the more active members of our San Diego Microwave Group recently took part in a DXpedition to the Isla de Guadalupe "XF1G." This island

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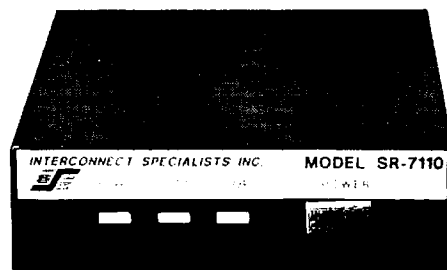
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is owned by Mexico and is located in the Pacific Ocean 155 miles west of Baja California and 350 miles south of Los Angeles. The 29th parallel bisects the island, placing it in grid locations DL08 and DL09. The main inhabitants of the island are thousands of chivos (goats). Human inhabitants reside on the southern half of the island and number around 50. They are primarily seasonal abalone and lobster fisherman, their families, and members of a small Mexican military detachment.

The main thrust of the expedition was to activate the island for the RS-GB-managed "Islands on the Air" (IOTA) program. The special IOTA designator for Guadalupe is NA-179. Participants were Jose Luis Ogawa XE2TT, Eusebil Morales XE2EAA, Felix Nunez XE2JNE, Bernardo Gonzalez XE2HWB (Photo B) and Jack Henry N6XQ. This is Jack Henry's account of that adventure:

Jose Luis did much of the planning, which involved negotiations with the Secretariat De Marine for prepositioning heavy and bulky items on the island. The generator, gasoline, antennas, tents, masts, beverages, etc. were transported by Naval frigate and stored at the island's marine base prior to our arrival.

At 1000 PDST on 14 May 1993, we departed Ensenada airport in a twin-engine Cessna. The flight was uneventful and in about an hour we were

circling the fishcamp. The flyover is the signal for the fisherman to load abalone and proceed to the landing strip which is about an hour's drive. After landing on the 6,000-foot runway, we had plenty of time to unload, take pictures and relax. Sure enough, about an hour later, a 1960 Jeep 1-1/4-ton truck appeared with what seemed to be about half of the fishcamp piled in back. The pilot placed a large tarp in the aisle of the aircraft and the fisherman transferred in more abalone than I had ever seen in my life. At about 1900 PDST all of the pre-deployed equipment, along with the gear we flew in with, was loaded into the truck and a small cargo trailer. The bumpy ride to the north yielded breathtaking views of the rolling volcanic hills, sheer drops to the ocean and an occasional sighting of a chivo herd.

Dusk signaled the arrival at our operating camp. We were in a little valley at the edge of a large forest of tall juniper and cypress trees. We immediately set up camp and erected a tribander. The first HF QSOs were made around midnight. HF conditions during the expedition were fair to very good.

Bernardo and I were the VHF operators for the expedition. The bands we operated were 6, 2, 223.5 MHz, 432, 1296 and 10 GHz. The first VHF QSO with the special call XF1G was with

W6OYJ in San Diego at 1550 on 15 May. Signals were good, but not super strong from this location, due to the rolling hills to the north of us. Morning and midday propagation were much better than the evening. We operated the VHF station on Saturday and Sunday from this site and moved the station to a 4,000-foot peak on Monday primarily to work 1296 and 10 GHz. The location was super. Phil W6HCC was setting his 10 GHz station in the San Bernardo mountains about 375 miles away. His signal on 10 GHz was S9 +40 dB. Subsequent 10 GHz contacts were made with N6CA, WA6CWM, WA6EXV, WA6CGR and WA6CDR. All were S9 +++ at distances better than 350 miles. W6HCC returned to his home QTH in Cherry Valley and bounced off the mountains to the north to work us with 5X5 peaks.

The best DX on 2 meters was with Dave WA6CGR, who was operating portable at Point Reyes, north of San Francisco, 700 miles distant. Dave was running 10 watts into a four-element yagi. Dave drove from Los Angeles primarily to attempt a 10 GHz North American record shot. There was high probability we would have made it if we had been at the higher location when Dave was there. (Dave was not available for the Monday attempt.)

All in all, there were 12 QSOs on

6 meters, 57 on 2 meters, one on 223, 17 on 432, six on 1296, and 10 on 10 GHz. Jack stated that if they had been able to operate on the mountain peak all three days, QSO totals would have tripled. Tuesday morning we packed up all the gear and headed for the fishcamp, where we would stay and wait for the flyover the next day for the return trip to Ensenada. The hospitality of the fisherman and their families was excellent. We slept in a one-room schoolhouse and our diet until the return was carne de chivo, frioles, and tortillas. The fishcamp had a pet chivo called "Chivo Loco" because it was mean and crazy. It would sneak up, chase, and try to butt members of our party with its long horns. We wondered how it escaped the dinner table.

The return flight was in a slightly larger plane and again uneventful. As an American, it was a real pleasure to work with the Mexican hams and be part of their culture for a week. They were most gracious and I was happy for the opportunity to participate in their DXpedition—de Jack N6XQ.

Well, that's it for this month. Next month I will describe a complete 10 GHz QRP SSB rig. As always, I will be glad to answer questions concerning this topic or other related VHF microwave material. Please send an SASE for prompt reply. 73 Chuck WB6IGP. 73

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Mobile Operations

It's lots of fun to sit in front of a desk with a radio and talk around the world. It's also fun to yack with the locals on the neighborhood repeater from the comfort of your home. But America is a very mobile nation; the average driver goes between twelve and fifteen thousand miles a year! That's a lot of time spent in the car. And let's not forget all the other kinds of travel, including airplane, bus, train, bicycle and good ol' shoeleather. This month, let's take a look at installing and operating portable and mobile gear.

In the Pocket

There aren't too many hams who don't have walkies. At least, it sure looks that way at hamfests, where seemingly everybody has an HT attached to his or her body. HTs, which normally cover VHF and UHF, are lots

of fun. There's no installation required; you just turn the radio on and go. If you're walking around town, an HT lets you stay in touch with friends. If you have autopatch privileges, it can be awfully handy to make phone calls home or to a friend's house, as long as you remember to observe the rule prohibiting business communications. Oh well, you'll still need a real phone to order that pizza!

My primary concern regarding walkies is over the energy my head is absorbing from that rubber duck antenna two inches from my eyeballs. Although there's lots of controversy about it, the government has established safety guidelines for close-up RF exposure. 2.5-watt 2 meter rigs don't appear to pose significant danger, but I'd avoid using more power than that. Let's face it, even if you go to 5 watts, the difference of 3 dB at the receiving end is minimal, so why risk it? Besides, the high power output kills your battery a lot faster.

Another way you can help yourself remain safe is to limit your transmission time. RF exposure damage oc-

curs over a period of time, and is measured with regard to the average total power absorbed, not the peak power. So, if you're putting out, say, 2 watts, but only transmitting a quarter of the time, that's the same as putting out 0.5 watts continuously. Let's face it, most hams are too darned long-winded anyway! Listening more and talking less could only do most of us good.

Auto Mobile

If you use your walkie in the car, you will quickly find that the rubber duck antenna works very poorly when enclosed in such a metal cage. Unless you're close to the repeater, you're going to get lots of complaints from other hams that you're scratchy or dropping out. Reception probably will be noisy, too. With a rooftop antenna, though, it's a different story. Your range will increase dramatically. Also, you're pretty well protected by the metal roof and the increased antenna-to-body distance, so why not have all the power you can? Most of today's walkies put out between 5 and 7 watts when run on 13.8 volt car power. Be careful, though, because they get awfully hot while transmitting and can actually damage your car's upholstery (or your hand). It seems reasonable to assume the high heat reduces the overall lifespan of the radio, too. To avoid it, just don't transmit for long periods of time.

Many hams do, in fact, use their

walkies in their cars, mostly to avoid the expense of another radio. It makes sense, with today's mobile rigs selling for between \$300 and \$600. If you've ever tried it, though, you know that using your walkie in the car has some drawbacks. First of all, there's the low audio output. Most modern walkies are rather small, and their 200 mW outputs and tiny speakers were never meant to be heard over the noise of an automobile. Also, many HT's speakers are rated for less power than their audio amps actually put out! Under normal circumstances it's no problem because you don't listen to it at maximum volume anyway. But in the car, it's easy to turn it all the way up and leave it there. Sometimes, the result is a blown speaker and a trip to the repair center. And, oh yeah, a bill.

Pump It Up

Is there a way out? Sure. What you need is a separate amplifier and speaker. A bigger speaker alone probably won't do you much good because the rig's little internal amplifier just isn't likely to have the power to drive it. In fact, some speakers, particularly those intended for music reproduction, are exceptionally inefficient and can actually sound *softer* than the little one in the radio! So, an amp is called for here.

You can build one easily enough; many amplifier designs have been

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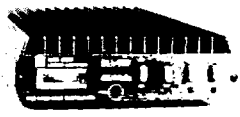
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published right here in 73 magazine. If you're not so inclined, you can buy one, too. But why bother? There's an easier, cheaper way: Use your car stereo! If you have a cassette player, you can use one of those cassette adapters intended for portable CD players by plugging it into your rig's earphone jack. Just cut off the adapter's plug (which is stereo) and replace it with a mono plug, connecting the wires for the two channels in parallel. Or, use a stereo-to-mono plug adapter. You probably will have to turn your walkie's volume down quite low, and you may find that there's too much background hiss, or that you can't get the volume down low enough. In those cases, put a resistor in series with the hot lead. I haven't tried this, but I'd imagine that 100 ohms to 1k ought to do it. Experiment with it until you find a resistor value that allows you to set your walkie's volume about a third of the way up. Then, adjust your listening volume with the stereo's volume control. If you don't have a cassette player but do have an FM radio, they make adapters which actually are little transmitters you tune in on your car radio. They should work fine, too.

It's an Intermod World

Using a walkie in the car, you may run into a more serious problem than puny audio. You may find that your re-

ceiver gets trashed pretty badly in certain parts of town. If you live in a large city, you're almost certain to run into this problem. We live in an RF-saturated society, and most areas have lots of paging transmitters and public-service towers and such, emitting plenty of power 24 hours a day. Unfortunately, walkies' front ends are very small, and there just isn't room for big filters. Also, today's units (with the exception of the Radio Shack HTX-202) permit reception over 20 or 30 MHz, requiring wideband front ends anyway. Some HTs use voltage-tracking front-end filters driven by the microprocessor to track the tuned frequency, and that does help, but some don't employ such techniques. Finally, walkies are primarily designed for receiver sensitivity because they are intended to be used with those little rubber dummy loads. Intermod rejection must, by necessity, take a back seat.

Is there a way out? If you're sufficiently knowledgeable to build your own bandpass filter, that will go a long way toward reducing the garbage. Of course, you'll have to give up public-service-band reception. Another way out would be to design an automatic antenna switch which selects the roof antenna for transmitting and an indoor duck for receiving. As I mentioned before, reception with an indoor duck can be poor, but sometimes it actually works better than what you get with an

overloaded receiver. I remember once, in Miami, having the repeater disappear altogether, only to get it back once I switched to the rubber duck. It was a classic case of front-end overload.

The Juice

Oh yeah, I almost forgot—you're gonna need to power your walkie, too. Sure, you can use the batteries, but why use them up when your car can power the rig? Besides, as I mentioned before, you'll get both more transmit RF and more audio output on 13.8 volts. To properly operate your radio, the DC power supplied to it needs to be clean. Clean power in a car? Forget it! All car power is loaded with alternator spikes, ignition noise, you name it. Also, the voltage can go up and down, sometimes by up to 2 volts, as you drive faster and slower. Yuck! Many walkies have direct DC input jacks, suggesting that you can simply plug them into your cigarette lighter and talk away. You probably can, but you'd be wise to take a voltmeter and check the voltage of your car's electrical system first. If it's over 15 volts with the engine going fast, you've got a regulator problem and you can save yourself a radio repair bill by straightening it out before you plug the rig in. Also, if your car radio or stereo has lots of alternator whine (distinguished by its being audible

when the volume is turned all the way down), don't plug the HT in. Alternator whine consists of fast spikes which can be several volts or more. They are too fast to affect voltmeter readings, but they sure can ruin a radio. I've seen electrolytic capacitors, RF power output modules, and especially audio amplifier ICs ruined by prolonged operation on such spiky power. Fix the car first.

Some cars are very electrically noisy, but are not actually broken in any way; they're just made that way. If yours is like that, consider a power filter. Some rigs offer them as options. Or, you can buy a generic choke and capacitor-type filter at Radio Shack or an automotive sound-system dealer. You only need something under 2 amps, so a small one should be fine. Just be careful to connect it *after* a fuse, or you could be headed for real trouble. A friend of mine forgot to do that and suffered \$400 worth of damage to his car, including a blown alternator, when the filter shorted to ground. A 50-cent fuse would have prevented the whole thing. Heck, you don't even have to add your own fuse; just connect your DC lead to the fused side of your stereo's power line.

Well, there's lots more to talk about, including mobile VHF/UHF rigs and, of course, the ultimate mobile operation: HF. Until next time, 73 de KB1UM.

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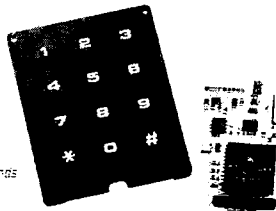
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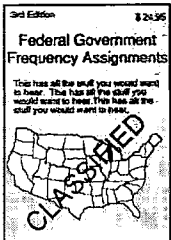
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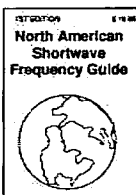


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CIRCLE 276 ON READER SERVICE CARD

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Notes from FN42

Ahhhhh! Another Field Day has been completed and a "good time was had by all!" As we were setting up a tower with a tribander on top, vertical antenna, wire antennas, VHF/UHF antennas, and satellite antennas, I was wondering why we go to all the trouble of setting it all up when in just a few hours (24 or so) we will be taking it all down again. But, after the first contact was made, that question seemed to answer itself. It's fun! Hopefully WS1A was heard and contacted by some of you. If not, well, there's always next year, and we are already critiquing this year's operation and making plans for next year.

A short FAX from David Horsfall, Ambassador to Australia, says that he has been very busy but will have some news for us next month.

Pay close attention to a packet message from Monk Apollo SV2ASP, Mount Athos. He provides us with the "real story."

Now, on to the news from around the world. 73, Arnie N1BAC.

Roundup

Ecuador Stuffed in the mailbox this past month was a copy of the program notes from radio station HCJB, Voice of the Andes. Since I know that some of you are also SWLers, you can also receive the same program schedules by writing: HCJB, Casilla 17-17-691, Quito, Ecuador, South America, and please tell them that 73 Amateur Radio Today sent you.

Israel Downloaded from packet originated by N1BEE @ KA1AZ as AMSAT News Service Bulletin 163.01: The Israel Polytechnical Institute will launch its first satellite, known as the Guerin-1, from the Baikonur space port in Kazakhstan, aboard a Russian rocket. Professor Guiora Shaviv, Director of the Space Research Department of the Institute said that the satellite will weigh about 60 kg. and will carry a packet radio Bulletin Board System (BBS) for amateur radio operations. This project involves the participation of 12 different Israeli companies. This satellite from "Technion," as the Polytechnical Institute is known throughout the world, was a project which began three years ago and will be placed in orbit as a secondary payload, along with a Russian satellite and another German satellite.

Please stay tuned for the AMSAT News Service bulletins for further details concerning the launch of this new amateur radio satellite.

The following report is from Arnold Samuels KH6COY: I must say that my last trip to Israel was FANTASTIC! I made contact with a group of hams in Natanya through Haim 4X6ZI. On very short notice, he called the hamdom of Natanya and the following hams showed up at a very pleasant meeting in the Hotel Goldar: Paul Gross 4X4UU; Haim 4X6ZI; Micha Klein 4Z4KM; Avner Hirschfeld 4Z4NH; Haylm Dentes

4X4DJ; Jose Cohen LU1HGA; Israel Berko 4X1OM; Haim Ken-tor (waiting for call letters).

They were really very hospitable and very enthusiastic to talk to an American ham. The group was eager to talk about ham radio in America and, since the Israeli license structure is patterned after ours, they also wonder if we are going in the right direction. It was a great experience to stand on 10,000 years of civilization. [Arnold Samuels KH6COY, 431 Bass Ave., Ocean Shores WA 98569]

Mt. Athos Downloaded from packet by Ron Gang 4X1MK, and sent to 73, originated by SV2ASP:

Greetings to all of you, DX friends all over the world.

I feel the need to communicate with you and to give you the real reasons, officially, why Mt. Athos is no longer heard on the air and when will it finally do so, because many rumors circulate and many things are written without containing a grain of truth.

I stopped broadcasting 15 months ago from Mt. Athos, because the ARRL has officially recognized the illegal broadcasts of the German ham Drobni-ca Baldu DJ6SI. I have in my hands all the legal documents which prove the fraud, and those recognizing the illegal broadcasts of the said ham.

This fact has caused a lot of upheaval here on Mt. Athos, as well as disgust, because it is against the articles of the Charter on the basis of which the Monastic Community is governed, and which has been respected for over 1,000 years, and which (Charter) has been respected by all, even the most cruel invaders.

The ARRL's taking this particular attitude allows—on purpose—time to go by and considers it a given fact. ARRL members spread the rumors that they will have Mount Athos removed from the DXCC countries list because it is no longer available on the air.

Dear Sirs: Mt. Athos is ready and waiting for the ARRL to live up to its responsibility and rise above interests and ulterior motives and cancel the illegal broadcasts of DJ6SI, so that Mt. Athos will be once again heard on the air.

Other rumors circulating about Mt. Athos going on the air again are totally misleading. They aim at placating the decent hams of the world who justifiably wish to establish contacts with Mt. Athos, the sole—on a worldwide scale—Monastic Christian Center with its rich history and its current growing presence, so they can acquire its coveted QSL.

I truly regret, dear friends, the way things have developed, but as a rationalist Orthodox Monk living here on Mount Athos, this locus of prayer and meditation, I cannot accept what has happened and what the ARRL continues to embrace with its official support.

I have faith in God that soon the correct solution will be provided by the ARRL and that this way I will once again join you on the air.

I send you my best wishes from Mount Athos.

God Bless You. Apollo, Monk, SV2ASP @ SV2DXC.TSL.GRC.EU. [Monk Apollo, Dochiariou Monastery, Mount Athos, GR-63087 Greece.]

Russia Downloaded from packet originated by Andy RW3AH: Only quite recently packet radio received a legal status in this country. But still we enjoy no expected "Big Bang" growth of this kind of communication. Yes, those who had a strong desire and could find money to buy themselves decent equipment are now already gaining their won experience. For the last three years, however, the number of packet radio stations increased very insignificantly, to say nothing of BBSs. This situation is certainly due to the general stagnation in our economy, though there is some light at the end of the tunnel.

At the end of 1992, Russian Amateur Radio Emergency Service (RARES) began developing a new local VHF packet channel on 144.650 MHz. The development of packet radio is going so fast that the brightest idea of amateurs is to set up a global packet radio network. TRANSPAK was started! Many organizational problems were overcome along the way. In a short span of time, we did as much as we could have done in the previous five years or longer. On May 4, 1993, we effected the first packet radio connection between Moscow (RW3AH) and New York (WA2NDV). Now we have a link with the American continent and Europe operating 24 hours a day!

This experimental link operates at 300 and 1200 baud (AX25). Today, we are able to communicate in real time with nearly all the continents. Constant forwarding with the U.S. is going fine.

We wish to express our special thanks to Frank WA2NDV without whose help and cooperation this project would probably still be on paper and not on the air. We also thank N2MH, WN9T, NT2X, RV6HY, and the teams at UZ3AWO and R3ARES club stations. [Andy RW3AH/WL7AP] @ R3ARES. #MOS.RUS.EU.]

Switzerland News taken from the International Telecommunication Union Press releases: Working Party 8A, chaired by O. Villanyi of Hungary, met in Tokyo, 13-22 January 1993, and approved six new draft recommendations on: cordless telecommunication systems; personal radio systems and digital short-range radio; future amateur radio systems, disaster communications in the amateur services; use of amateur services in developing countries; and frequency-sharing criteria in the amateur services. [No mention was made of what the recommendations said.—Arnie]

Future meetings known to include amateur radio working groups are: Study Group 8 on 26 October and 21-25 March 1994 in Geneva for mobile, radiodetermination, amateur and related satellites services; Working Party 8A 27 October to 5 November in Geneva covering land mobile service, excluding FPLMTS; amateur and amateur satellite services.

Task Group 8/2, chaired by P.L. Rinaldo (USA), met in Boulder, Colorado, 19-23 April 1993, and was attended by participants from various fields. They reached a common understanding about the situation of wind profiler radars and other services which might

have interferences to or from the wind profiler radars. The meeting produced the following results: one preliminary draft on technical and operational characteristics; four preliminary draft elements of the report to the Radio Communication Conference concerning general subject matters and candidate bands around 50 MHz, 400 MHz, and 1 GHz.

The Africa TELECOM 94 Exhibition and Forum will be held in Cairo, Egypt, from 25 to 29 April 1994. The Forum will be held under the theme: "Integrating Africa Regionally and Globally—A Challenge for Telecommunications and Development." For further information contact: Mr. Tom Dahl-Hansen, Executive Director, TELECOM, or Ms. Suzan Hee-Sook Lee, Project Manager, Africa TELECOM 94, ITU, Place des Nations, CH-1211 Geneva 20, Switzerland.

HONG KONG

Phil Weaver VS6CT
Flat 39C Two Park Tower
1 Kings Road
Hong Kong

As with everything else in Hong Kong, it can take an awful long time to get things done when it comes to recreational activity, as business always takes the front running when it comes to people's time, and as a result many of the planned improvements to amateur radio in Hong Kong, such as an extra repeater, renewal and installation of new beacons, packet cluster for ELARCS, and many other interesting projects which your committees are trying to implement, are slowly progressing. As most of you know, ELARCS has at last got its cluster up and running on 144.500 MHz, and we hope to shortly have a node up with the repeater so that the coverage can be improved and perhaps even get into Macau. Other improvements are in the pipeline, and we hope that 1993 will see many of these completed.

One of the topics currently being discussed by the H.F. Committee of the Radio Society of Great Britain (RSGB) is the question of access to the HF bands (below 30 MHz) without the necessity of a Morse qualification. Such a license would be referred to as a "code-free license." The RSGB tells us that amateur radio is controlled internationally by the regulations set by the International Telecommunication Union (ITU), which is an agency of the United Nations. They add that the current ITU regulations require that radio amateurs operating at frequencies below 30 MHz demonstrate their proficiency at sending and receiving Morse code, though the speed and nature of any test is not specified. The RSGB wishes to consult as widely as possible and seeks input on the question of a code-free license from any radio amateur or listener, whether they are for or against the idea of such a license. You should send your views, opinions and comments to: The HF Committee, c/o RSGB HQ, Lambda House, Cranborne Road, Potters Bar, Herts. EN63JE, United Kingdom. Letters should be clearly marked "Code-Free License" on the bottom left-hand corner of the envelope. Since Hong Kong is still a territory under the jurisdiction of the U.K. on international matters, at least until 1997, amateur radio here basically still follows their lead.

Finally, I would like to extend an open invitation to any of our readers that they are interested in a visit to the Maritime Rescue Coordination Centre located on the roof of the Rumsey Street Car Park Building in Sheung Wan to see the investment that the Hong Kong Government has made in the field of Communications associated with the implementation of the Global Maritime Distress and Safety System, they will be made very welcome. Please call Phil Weaver on 543 5558 during office hours to make an appointment.

Regards and 73 from "China Town."

MONACO

Daniel Plett 3A2LZ
B.P. 349
MC 98007
Monaco

Monaco hams quite often get asked the same questions from many U.S. hams. Here are some of the questions and how we'd respond.

1. Are there many active hams in Monaco? There are about 50 licensed hams with about 12 of them being fairly active on an international scale.

2. Is anyone active on CW, RTTY, AMTOR, packet, SSTV, etc.? One Monaco ham, by himself, does about 1,500 QSOs a year, mostly on CW, and most others do at least some. There are three or four equipped for RTTY but only one active right now. No one is currently active on AMTOR or packet.

There are a few equipped for SSTV, but no one is regularly active.

3. What about a DXpedition? There is no problem getting a reciprocal permit. The big problem is finding a place to operate. Monaco is extremely small and crowded and doesn't have much space for portable operation. Only one or two of the most expensive hotels allow antennas and radio activity. Many visiting hams in the past have abused their privileges, broken laws, and invoked the ill will of local hams. Most portable/mobile operations from Monaco end up being illegal one way or the other, and their contacts cannot be counted for DXCC credit.

4. How about a sked? Most Monaco hams are quite pleased to work U.S. hams, but don't usually make skeds. There are three main hindrances. The surrounding mountains have at least a 30 degree elevation, making low-angle radiation difficult. Most of us are limited to multiband vertical antennas. The 100 watt power limit makes it difficult to be heard through the rest of Europe. Here are two hints: 1) Think about local times. Most of us are working folks who have to keep somewhat civil hours. 2) Try long-path. Some U.S. hams check in quite easily to European DX nets this way and we do have low-angle radiation to the U.S. via long-path.

That's all for this time. If any of you have more questions, other than what I have covered, please contact me at my address, or pass the question to Arnie at 73 and he will get it to me. 73 to all.

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Ham Doings Around the World

SEPT 5

BURLINGTON, IA The Iowa-Illinois ARC Inc. will host "Burlington Hamfest '93" from 7:30 AM-3 PM, at the Iowa Army Nat'l. Guard Armory, Summer St. Rd. (across from Burlington Municipal Airport). VE Exams. Talk-in on 146.790/190 WOLAC/R, and 146.520 simplex. Get details from **Chuck Gysi N2DUP, Burlington Hamfest '93**, P.O. Box 911, Burlington IA 52601-0911. Tel. (319) 752-3000.

SEPT 9-12

FORT MONMOUTH, NJ Members of the WW II Electronic Training Group will be holding a four-day reunion. Details are available from **Harrison W. Moore, Jr., COL SIG C (Ret)**, 260 Millard Ave., No. Tarrytown NY 10591. Tel. (914) 631-3683.

SEPT 11

BALLSTON SPA, NY Saratoga County R.A.C.E.S. Assn., Inc. will hold "Hamfest '93" at the County Fairgrounds from 7 AM-3 PM. Talk-in on 146.40/147.00 and 147.84/24 WA2UMX/R. Contact **N2FEP**, P.O. Box 41, Rock City Falls NY 12863.

ERIE, PA The Radio Assn. of Erie will sponsor "Erie Hamfest '93" at the Franklin TWP Fire Hall, from 8 AM-2 PM. VE Exams at 9 AM at Franklin Center Methodist Church, Rt. 98 (1 mile north of Hamfest). Talk-in on 146.01/61. Contact **Erie Hamfest '93**, Tom McClain N3HPR, 3954 Solar Dr., Erie PA 16506. Tel. (814) 833-1640.

HARMONY, NJ The "Flemington Fallfest" will be held by the Cherryville Repeater Assn. from 8 AM-2 PM at the Warren County Fair Grounds, Route 519. VE Exams. Talk-in on 147.375+ and 146.820-. Contact **Keith Burt KF5FK**, P.O. Box 308, Quakertown NJ 08868-0308. Tel. (908) 788-4080.

CHANUTE, KS Chanute Area ARC will sponsor a Hamfest at North Malcolm Community Center from 8 AM-3 PM. Contact **Jon Wood W0UHL**, RR2 Box 163A, Chanute KS 66720.

SEPT 12

FINDLAY, OH This year the Findlay RC is having its 51st annual Hamfest at the Hancock County Fairgrounds, East Sandusky at Fishlock. Talk-in on 147.15+ mc rpt. Call (419) 423-1440 for details.

JOLIET, IL The Bolingbrook ARS will hold its 8th annual Hamfest/Computer Fair at Inwood Rec. Center, 3000 W. Jefferson St. (Rt. 52), beginning at 8 AM. VE Exams for all classes, from 9 AM to Noon. Table Reservations: **Ed Weinstein WD9AYR**, 7511 Walnut Ave., Woodridge IL 60517. Tel. (708) 985-0527. For more info, call (708) 739-9309.

MONETT, MO The Ozarks ARS will hold its annual Picnic and Swapfest from 8 AM-2 PM at the Monett City Park, located at the intersection of Hwys. 39 and 60. Talk-in on 146.97- and 146.52. Contact **Gary Meyers**, 1201 S. Madison, Aurora

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check **Special Events File Area #11** on our BBS (603-924-9343). For listings that were too late to get into publication.

MO 65605. Tel. (417) 678-3376.

OLD WESTBURY, NY The Long Island Mobile ARC will sponsor a Hamfest at the New York Institute of Technology, Route 25A, from 9 AM-4 PM. Talk-in on 146.25/85 Contact **Neil Hartman WE2V**, (516) 462-5549.

SOUTH DARTMOUTH, MA The South Eastern Mass ARA will hold their 6th annual Hamfest & Flea Market from 8 AM-3 PM at the Club grounds at 54 Donald St. Talk-in on 147.00/60. Contact **Michael Enos**, P.O. Box 79064, North Dartmouth MA 02747.

SEPT 17-19

VENTURA, CA The American Radio Relay League Southwestern Div. Convention Keynote Address (The Search for Extra Terrestrial Intelligence: or, Chasing the BIG DX) will be given by Dr. D. Kent Culter WA6TWX, at the Ventura Holiday Inn, as a part of "HamVenture '93." For more details write to **HAMVENTURE '93**, P.O. Box 3000-267, Santa Barbara CA 93130.

SEPT 18

BERWICK, PA A Hamfest/Computerfest will be held, starting at 8 AM, at the Beach Haven Carnival grounds by the Columbia Montour ARC. VE Exams at 1 PM (by advanced registration only). Talk-in on 147.225 (+600) or 146.52 simplex. For info, reservations, call **Dave WC3A** at

717-752-6851.

GLORIETA, NM The Northern New Mexico ARC invites you to attend their annual Hamfest which will be held in the Aspen Bldg. from 8:30 AM-4 PM at the Glorieta Baptist Conf. Center. Talk-in on 146.52 simplex, 145.19- or 147.30+. ARRL VE Exams for all classes; to register contact **Bonnie Griffiths KD0JQ**, 190 Manhattan Loop, Los Alamos NM 87544. Tel. (505) 662-9155. Flea Market contact: **Helenrose Burke W5IXS**, P.O. Box 73, Ojo Sarco NM 87550.

GONZALES, LA The 1st annual "Gonzales Hamfest '93" will be held at Gonzales Rec. Center from 8 AM-3 PM. Sponsored by the Ascension ARC. Talk-in on 147.225+. CTCSS 107.2. Contact **Wayne Russell**, 40390 Sycamore Ave., Gonzales LA 70737. Tel. (504) 622-3964.

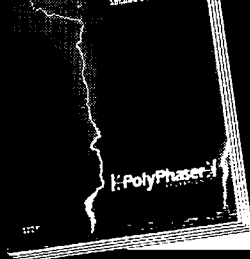
SEPT 18-19

PEORIA, IL The Peoria Area ARC will sponsor the 34th annual "Peoria Superfest" at Exposition Gardens, Northmoor and University Sts., beginning at 8 AM. Talk-in on 146.76/R. Contact **The Peoria Area ARC**, Box 3508, Peoria IL 61612-3508. Tel. (309) 685-6698.

SEPT 19

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club, will hold a Flea Market from 9 AM-2 PM at Albany

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MT. CLEMENS, MI The 21st annual L'Anse Creuse ARC Swap and Shop will be held from 8 AM-2 PM (EDT) at L'Anse Creuse High School. VE Exams at 11 AM; contact Don Olszewski WA8IZV, (313) 294-1567; Prodigy #SSTG41A. Talk-in on Echo Rptr. 147.08/68 MHz or on 146.52 MHz simplex. Flea Market contact: Ted MacKinnon NW9W, 19534 Warwick, Beverly Hills MI 48025-3970. Tel. (313) 647-1628, ((517) 595-2309 from 6/28/93 to 8/21/93). (Compuserve 71303.2244).

SANDYHOOK, CT The Candlewood Hamfest will sponsor an ARRL sanctioned Hamfest at the Sandyhook Firehouse, beginning at 8 AM. Talk-in on 147.12. Contact Candlewood ARA, P.O. Box 3441, Danbury CT 06813-3441. Tel. (203) 438-6782; (203) 792-1845; (203) 426-1652.

SEPT 24-26

WICHITA, KS The 1993 Kansas State ARRL Hamvention will be held for 3 days at the Ramada Broadview Hotel on Douglas and Waco Sts. ARRL/VEC Exams. Saturday Banquet. Contact Len Warren N0QHZ, 6233 Millsboro, Wichita KS 67219-1637. Tel. (316) 744-1930.

SEPT 25

DANVILLE, VA The Danville-South Boston Hamfest will be held at the Nat'l Guard Armory. W5YI Exams on a pre-registration basis. Get details from Bonnie Manasco AB4KO, 2107 S. Boston Rd., Danville VA 24540. Tel. (804) 822-6070 (work); (804) 822-5345 (home).

ELMIRA, NY The Elmira ARA will present the 18th annual Internat'l Hamfest at the Chemung County Fairgrounds. Horseheads NY, from 6 AM-5 PM. Loads of events. Talk-in on 147.96/36 or 444.20 Rptr. Contact Dave Lewis, RD1 Box 191, Van Etten NY 14889. Tel. (607) 589-4523.

SEPT 25-26

YORK, PA The 38th annual York Hamfest/Computer show will be held at the York Fairground on Rt. 74, Carlisle Ave., from 8 AM-4 PM each day. Table contact: (717) 764-4805. Talk-in on 146.37/97. VE Exams Sat. only, at 9 AM. For info, write to York Hamfest, P.O. Box 351, Dover PA 17315.

SEPT 26

ADRIAN, MI The Adrian ARC will hold their 21st annual Hamfest/Computer Show at Lenawee County Fair Grounds from 8 AM-2 PM. Walk-in VE Exams. Talk-in on 145.370. Contact Dennis Boydston WB8Z, 2383 E. Clearview Dr., Adrian MI 49221. Tel. (517) 265-8054.

BUTNER, NC The Falls Lake ARC will sponsor its 2nd annual Hamfest at NCNG Armory from 8 AM-4 PM. Contact Fred KC4VSO, FLARC, P.O. Box 502, Butner NC 27509. Tel. (919) 575-4262.

CLEVELAND, OH The Hamfest Assn. of Cleveland, Inc., will present The Cleveland Hamfest and Computer Show at the Cuyahoga County Fairgrounds, Berea OH. Doors open 8 AM-4 PM. VE Exams. Talk-in on 146.73, 6 AM-12 PM. Banquet Sat. night. Speaker TBOA. Write to C.H.A., P.O. Box 81252, Cleveland OH 44181-0252.

LONGMONT, CO The Boulder ARC will host its Amateur Radio Electronics/

Computer Swap Meet at the Boulder County Fairgrounds Exhibition Bldg., Nelson and Hover Rds. Doors open at 8 AM. For VE Exams/Table Spaces, call (303) 440-3627. Mail reservations (deadline Sept. 18th) to BARCFEST, 726 19th St., Boulder CO 80302. Talk-in on 146.70.

ST. PETERS, MO The 9th annual St. Peters ARC Swapfest will be held in the rear parking lot of St. Charles County Community College, from 7 AM-1 PM CST. Talk-in on 145.41 MHz and 444.275 MHz. Contact Wall Franzer WX0C, 1333 Pegasus Trail, St. Peters MO 63376. Tel. (314) 278-1993.

SPRINGFIELD, IL Sangamon Valley RC Hamfest will be held at Sangamon Co. Fairgrounds in New Berlin from 8 AM-1 PM. VE Exams 8 AM-9:30 AM. Statewide Packet BBS meeting at 11 AM. Talk-in on 147.315, 224.68. Contact Don Pitchford WD9EBK, RR#1 Box 104, Springfield IL 62707. Tel. (217) 789-4519.

YONKERS, NY The Giant Electronic Fleamarket, sponsored by Metro 70cm Network, will be held at Lincoln High School on Kneeland Ave. from 9 AM-3 PM, rain or shine. VE Exams. Talk-in on 440.425 MHz pl 156.7, 223.76 MHz pl 67.0, 146.91/31 Rptr., 443.350 MHz pl 156.7. Contact Otto Supliski WB2SLQ, (914) 969-1053.

OCT 2-3

LOUISVILLE, KY The Greater Louisville Hamfest/ARRL KY State Convention will be held at the Commonwealth Convention Center, downtown Louisville, Sat. 8:00-17:00, Sun. 8:00-15:00. Contact Greater Louisville Hamfest Assn., P.O. Box 34444-S, Louisville KY 40232-4444. Tel. (502) 551-4118.

VIRGINIA BEACH, VA The Virginia Beach Hamfest and ARRL Virginia State Convention will be held at Virginia Beach Pavilion. Commercial vendors contact Lewis Steingold W4BLO, 3449 Dickens Dr., Virginia Beach VA 23452. Tel. (804) 486-3800. VE Exams by the South Peninsula ARC on Oct. 3rd.; call Ed Brummer W4RTZ, (804) 898-8031.

OCT 3

HUNTINGTON, IN The Huntington County ARS will sponsor its 5th annual Hamfest from 8 AM-2 PM at the PAL (Police Athletic League) Club in Huntington. VE Exams. Talk-in on 146.085/685 and 448.975/443.975. Contact Ray Tackell KC9DZ, 420 Market St., Andrews IN 46702.

MANSFIELD, OH The AAARC will host the North Central Ohio Hamfest from 8 AM-3 PM, at the Ashland County Fairgrounds. Talk-in on 147.105+. Contact Wally Green W3YXS, (419) 281-3903.

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Park, 47-01 111th St. Doors open 9 AM. Talk-in on 444.200 WB2ZZO Rptr., and 146.52 simplex. Contact (night time only) Arnie Schiffman WB2YXB, (718) 343-0172, or Charles Becker WA2JUU, (516) 694-3955.

SPRINGFIELD, OH The Independent Radio Assn. will hold its annual Springfield Ohio Hamfest/Computer Show from 8 AM-4 PM at the Clark County Fairgrounds. Talk-in on 145.45 and 224.26 MHz. For reservations, write to Independent Radio Assn., P.O. Box 523, Springfield OH 45501 (SASE); or call Carl Patterson K8LGS, (513) 323-6680.

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SPECIAL EVENT STATIONS

SEPT 4-14

McDERMOTT, NV The O.I.N. 3 States DX-pedition, sponsored by the Vancouver Mountain RC, will operate W7WY from the state line of Oregon, Idaho, and Nevada. Operations will be CW and phone, 160 thru 10m, 24 hrs a day in the General portion of the band; also 12, 17, and 24m. For a certificate or QSL card, send an 8" x 12" SASE to *Vancouver Mountain Radio Club, W7WY, P.O. Box 1622, Vancouver WA 98668.*

SEPT 8-16

KIOWA, KS The Salt Plains RC will operate WA0HH/W100CS, to commemorate the 100th Anniversary of the opening of the Cherokee strip land rush into Oklahoma. Special QSL by #10 SASE. Frequencies: +/- 20 kHz, 3.900, 7.235, 14.250, 21.325 and 28.500. Contact *Kiowa Cherokee Strip Centennial, 717 Coats, Kiowa KS 67070.*

SEPT 10-12

NORWALK, CT The Greater Norwalk ARC will operate KA1OFN Sept. 10 2100Z-2100Z Sept. 12, to celebrate the 17th annual Oyster Festival and the 125th Anniversary of Sheffield Island Lighthouse. Operation will be in the lower 25 kHz of the General 80, 40, 20, and 15m phone subbands, and the Novice 10m phone subband. For a certificate, send QSL and SASE to *Greater Norwalk ARC, c/o Norwalk/Wilton Red Cross Bldg., 43 North Ave., Norwalk CT 06851.*

PORT TOWNSEND, WA Jefferson County ARC will operate at the Port Townsend Wooden Boat Festival, between 1700 UTC and 2400 UTC, on the General bands for 15 and 20m, and

28440 on 10m. The event station, W7LD, will reciprocate with an event QSL card. Send QSL and SASE to *Oilly Gardner KA6OZZ, Box 65156, Port Ludlow WA 98365.* Contacts will be made with Marine Nets.

TULELAKE, CA The Keno ARC will operate Station WD6EAW at the Tulelake-Butte Valley Fair. Operation will be in the lower portion of the General bands from 1600Z-2400Z. For a special QSL card, send an SASE to *WD6EAW Special Event, P.O. Box 653, Keno OR 97627.*

SEPT 10-13

PUT-IN-BAY, OH Members of the Oliver Hazard Perry Expeditionary force will operate KB8BN to commemorate the 180th Anniversary of the "Battle of Lake Erie." Frequencies: 7.240, 14.240, 21.365, 28.365. For a certificate, send QSL and 9" x 12" SASE to *Commodore Jim Yoder KB8LDG, 11796 Shadybrook Dr. NW, Pickerington OH 43147-9122.*

HIGHLANDS, NJ The Ocean-Monmouth ARC (OMARC) will operate 1600Z Sept. 11-1600Z Sept. 12, to commemorate the Marconi Memorial Twin Lights Lighthouse Radio Site. CW - up 10 kHz from bottom of Novice subbands; 10.145, 14.045, 18.080 MHz; bottom of General 80-15; Novice 10m phone subbands. For a certificate, send 9" x 12" SASE (or U.S.) to *OMARC, P.O. Box 75, Bradley Beach NJ 07720.*

SEPT 12-30

OAK RIDGE, TN The Oak Ridge ARC will sponsor a second Special Event, on all bands, to commemorate the 50th Birthday of the City of Oak Ridge, the site of the original Manhattan Project. "We were born of War, are Living for Peace and

Growing through Science." A four color certificate is available. Please SASE to operators' home call.

SEPT 13-18

ATLANTIC CITY, NJ Southern Counties ARA (SCARA) will operate K2BR for 5 days, from the Miss America Pageant (Absecon Island, IOTA: NA 111). Time: Starting at 10 AM EST. Frequencies: Phone - 25 kHz inside lower General bandedge; CW - 65 kHz inside lower General bandedge; Novice - 28.100, 28.500 kHz. To QSL, send #10 SASE via *SCARA, P.O. Box 121, Linwood NJ 08221.*

SEPT 18-26

KELLEYS ISLAND, OH Members of the Massillon and Canton ARCs will help commemorate the Lake Erie Commission Coastweeks projects by operating WD8DEA/N8LCS from the Kelleys Island Scuba Shipwreck tour Sept. 19th, and the Put-in-Bay Harbor Cleanup Dive, Sept. 20th. Operations will be in the General and Novice bands with phone on 3.880, 7.280, 14.280, 21.280 and 28.380 MHz. CW - 3.685, 7.110, 21.110 and 28.100 MHz. Packet - 145.07; phone - 147.475 MHz. Send QSL and SASE c/o *Jack Wade, P.O. Box 537, Kelleys Island OH 43438.*

SEPT 24-26

PEA PATCH ISLAND, DE The Tir-Cunly Amateur Group will operate KD3XN 1400Z-2100Z, from historic Civil War Fort Delaware. Operations will be in the General and Novice portions of 10, 12, 15, 17, 20 and 40m. For a color aerial view QSL, send QSL and SASE to operator worked.

SEPT 25-26

ECKLEY, PA The Down River ARC will operate N3JPS Sept. 25 1400Z-1800Z Sept. 26, to commemorate the 50th Anniversary of the original flag raising at Eckley Miners' Village in Luzerne County PA. Operation will be in the General subbands and in the Novice 10m subband. For a beautiful certificate, send QSL and a 9" x 12" SASE to *Rob Barnshaw N3JPS, 540 Church St., Royersford PA 19468.*

WARRENS, WI The Monroe County ARC will operate KA9ETH, 1400Z-2200Z Sept. 25; 1400Z-1900Z Sept. 26, to commemorate the 21st Annual Warren's Cranberry Festival. Frequencies: 14.270, 21.370, 28.370. For a certificate, send a QSL and a 9" x 12" SASE to *Marshall Kiel N9FVU, P.O. Box 344, Tomah WI 54660.*

OCT 2

ANAMOSA, IA The Jones County ARC will operate N0CWP 1500Z-2000Z, to celebrate their annual Pumpkinfest. Operation will be on the lower 50 kHz of the General subbands. For a certificate, send confirming QSL to *Jim McClintok N0CWP, Box 462, Morley IA 52312.*

OCT 2-3

BETHEL PARK, PA The Breeseshooters ARC will operate W3XX from the U.S.S. Requin SS481, a Trench Class WWII submarine, 1400Z-2100Z both days. Frequencies: Phone - 28.450, 21.350, 14.250, 7.250, and 146.52; CW - 28.150, 21.050, 14.050 and 7.050. For a QSL card and certificate, send 8 1/2" x 11" SASE to *Ron Berry WB3LHD, 326 Sunset Dr., Bethel Park PA 15102.*

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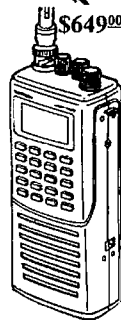
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NEVER SAY DIE

Continued from page 4

We're still the only group of communicators capable of providing dependable emergency communications. We're the only group able to help CBers, police, fire, and other fixed and mobile radio services communicate with each other.

But Not for Long

It isn't going to be long before we're going to see satellite communications making it possible for anyone to communicate with any car, truck, plane, boat or ship anywhere from Hawaii to England. I don't know how many outfits you have in your part of the country working on this technology, but we've got one in Manchester, New Hampshire, that's well along with a spread spectrum system which will let almost any number of units keep in touch. Companies will know exactly where every one of their trucks is at any moment, and will get instant word via a bar-code reader of every pickup and delivery. Your portable computers will be able to communicate with anyone anywhere via this network. Mobile units will not only provide positioning information, but will allow voice, fax, and computer communications . . . if you want.

The antennas for these little buggers are small enough to be built into car tops. And will be. Small umbrella-like antennas will allow HTs and notebook computers to join the network.

All this will probably take 10 to 20 years to become ubiquitous, but when it does why will anyone need amateur radio emergency communications? For what? Then what will be our excuse for keeping our bands?

Yes, of course I have a solution, but old-timers are going to hate it. Of course, with the average ham age in the 50s now, most of the old-timers will have been awarded their Silent Key certificates, so it's not their problem. My proposal is to get busy starting radio clubs in our schools and bring in a flood of youngsters. If we can turn amateur radio into a recruiting ground for high-tech interested youngsters we'll be worth our frequencies.

If you have the idea that the no-code license has attracted a big bunch of kids to the hobby, you are dreaming. The figures I've seen show that about 12% of our newcomers are youngsters. Back before we killed off 95% of the school radio clubs 30 years ago, 80% of all new licensees were youngsters. And 80% of them went on to high-tech careers.

If we can start attracting youngsters again we'll not only get them interested in high-tech careers, we'll start seeing some inventing and pioneering again. All of the major technical developments amateur radio has pioneered were made by relative youngsters. I know because I was there for many of them and knew the chaps involved personally. I was one of the first experimenters with narrowband FM (NBFM). Ditto

SSB. Ditto RTTY. Ditto SSTV. Ditto 10 GHz. Ditto 6m. Ditto beacons. Ditto repeaters.

No, I haven't done much lately. I got all wrapped up with computers almost 20 years ago and got sidetracked. Heck, I'm still wrapped up with computers. Then I got re-involved with hi-fi audio and digital sound. So now I have one of the finest recording studios in the world.

More and more of our ham clubs are sponsoring school radio clubs. Way to go. I'd like to see more pictures I can publish. And I'd like to see more about this in the club newsletters.

It's probably getting almost time to start discussing what we think is the best kind of license exam to go with hamming in the '90s. Our exams are still hung up back in the Dark Ages. What should a youngster be able to demonstrate to us to be worthy of a license? And does the long ladder of license classes fit in with hamming the way is today?

For many years I've recommended we change to just one class of license and depend on the fun of learning and doing things to build knowledge. The current licensing system is a joke. The test questions and answers are published, so it's purely a memorization exercise and has little to do with actually learning anything. It would be nice if our ham clubs would organize technical sessions at the start of their meetings. This might help the members to understand how antennas and feedlines work. It could help them understand the basics of receivers and transmitters. And how about some tech talks on packet, RTTY, SSTV, and other ham communications modes? Is your club offering tech sessions like these? Why not? This is supposed to be a technical hobby, right?

One of my problems is that I not only recognize that change is inevitable, I actually welcome it. I enjoy change. This may have a lot to do with the host of enemies I've generated . . . and every one of which I am proud. So let's think in terms of how things are going to change and how we can best adapt to it so we'll continue to have a hobby, even under the new conditions.

2020 Vision

What will amateur radio be like in the year 2020? Or will our hobby still be around? If so, what purpose will it serve that would validate its cost to the public? And what technological developments do we see emerging which will affect our future?

One fast-emerging technology which is encroaching on our turf is the network bulletin-board systems such as CompuServe and Prodigy. These allow people to go on-line and talk with each other about any mutual self-interest. An ad in *New York* magazine for their network has an international chat line where you can talk with people all over the world one-on-one in real time about anything you want. It also allows you to get information about restaurants, movies, plays, stocks, etc., and even play chess.

There are thousands of bulletin boards. Most are dedicated to special interests, but there are a growing number of wide-interest systems and people are getting caught up in these by the hundreds of thousands. Sure, they run up telephone bills, but there's no interference, no fading out, no pile-ups . . . just solid contacts.

Well, okay, on-line services are going to do nothing but grow. We're going to need help in finding out which services provide what, how good they are, and how much they cost to use. That information will be available on-line too.

But what about when we're driving or walking? Well, driving, since we don't walk much any more except to walk or jog just for the exercise it provides. We don't want to be out of touch just because we're mobile. Our systems will have to enable us to stay in contact when we're in our cars, on planes, or at sea.

It isn't going to take 27 years for satellite communications technology to extend our telephone wires, figuratively speaking, into our cars. By 2020 our homes and offices may all be connected by fiber optic networks. Or we may have gone all satellite. I expect it'll be a combo, with satellite links used mainly to interconnect to mobile units and fiber optics for fixed.

The amount of data we'll be zipping around will be far beyond what wires or even cables can handle. TV looks as if it'll be moving from 100 channels to TV-on-demand, making it so you won't have to record the 2020 version of "Murphy Brown" so you can see the program when you prefer instead of when the TV network program director decides. Your TV set will be more like tapping into a humongous video rental store. You may not even have to pay for the programs if you'll put up with the automatically inserted commercials. Fast-forward through 'em and your bill goes up.

We're already starting to see the development of spread spectrum satellite communications systems which will enable every car, truck, plane, boat and ship to tie into the network. People in cars will be able to keep in touch with anyone anywhere, either by voice, voice-messaging, or a fax-like system. You'll be able to be reached, but only if you want, no matter where you are. We'll adapt to this.

Since most of my work requires privacy, I'm reachable by phone about an hour a day. I read a lot. I write a lot. Neither of these activities are compatible with answering the phone or dealing with visitors. When I write I build a general picture of what I want to cover and then start getting it into my laptop computer. If someone comes in with a question or the phone rings, pffft, the picture is gone. So I do 99% of my productive work in my office at home. I drive to my business office for an hour or two a day for meetings with the staffers, and to answer phone calls. I use the 10-minute drive to review new compact disc releases, so even my driving time is productive.

I'm in touch with the office by phone and fax, if they need me. But I try to get my people to be self-reliant. I look for people who don't need much direction. It has not been easy finding them. Our school system, as I've written, goes to lengths to stamp out the very traits I find valuable.

I've gone into some detail on this because I believe more and more people will be wanting to work as I do. The day of the home-office is coming fast. As our communications systems improve there will be less need for going to "the office." We'll be able to video conference from anywhere for meetings. People wanting to talk with me will be able to find out what times are best (1000-1100 Eastern), and get through with one call. Even my production crew will be able to put together magazine pages remotely. From anywhere.

So where does amateur radio fit in when anyone will be able to talk with anyone anywhere in the world at will . . . and at a reasonable cost? When we have work on-line services where people interested in Italian Greyhounds can easily find and talk with each other, complete with video? When Gilbert & Sullivan fans can sing in groups, even when one is on a boat in California and another is driving in Maine?

We may even find people going to weird places to cater to a 2020 version of DXCC for people who are collecting the places they've talked with. Will there be pile-ups for some idiot fighting the tide on Minerva Reef? Computerized systems will allow tens of thousands of contacts per minute, so maybe not.

We do know one thing for sure. The communications systems of 2020 are going to require quite a bit of spectrum, even with spread spectrum systems, so we'll be losing our microwave channels before long. We've never used 'em anyway, so it won't seem like a big loss . . . at the time. They were a hold-over from the early experimental radio days that we will only appreciate after they're gone.

A few of us old-timers can still remember the stink when we lost the 7,300-8,000 kHz band and there was talk of the League having sold us out. The sudden building of expensive houses by several League officials didn't tend to quiet the rumors of a payoff for the loss of frequencies.

With the need for short-wave commercial communications eliminated by satellite and fiber optic systems, we may be able to not just hold on to our low bands . . . we may be able to increase them. Thus, in 2020, we may well see a few old-timers sitting there sending CW with their hand keys, just like they are now . . . and their grandfathers were 70 years ago. But the mainstream of communications will have passed us by. As commercial short-wave communications systems and broadcasting disappear we may be able to go back to spark on 200 meters, thus keeping alive the raison d'être of the American Radio Relay League. You can bet I'll be sporting my

80-year membership pin at Dayton in 2020 and showing holographic videos of my narrowband quenched spark rig.

"Nothing Endures Like Change"

The ancient Greek philosopher who said that wasn't speaking for amateur radio, where change is glacial, and fought bitterly. As Canadian Department of Communications official Peter Alien recently said, "Slow growth and a closed-shop mentality have led to the graying of amateur radio."

When I started hamming the entry code speed was 13 wpm and the technical exams were at about college level. In the late 1920s hams had to build their own receivers, since little was available commercially. As soon as commercial receivers were introduced amateurs stopped building them.

By 1938, when I talked with virtually every active ham in Brooklyn (NY), I was able to find only one ham who'd built his own receiver. We were still building our transmitters, not because building was fun, but because there were none available commercially. Not even kits.

After WWII we got busy converting military surplus transmitters, but it wasn't long before a wide range of commercial transmitters and kits appeared. That quickly put an end to around 90% of ham home construction. Pioneering hams still had to build VHF gear and gadgets for new modes such as NBFM, RTTY and SSB. But as soon as there were enough hams interested in a new mode, commercial gear became available and home construction blew away.

I built my first SSB rig in 1954. By 1959 Hallicrafters had a miniature transistorized sideband transceiver on the market which was far beyond anything I could hope to build. I made an around-the-world DXpedition in a MATS C-54 plane in 1959, operating SSB from 22 countries using Hallicrafters SSB equipment.

Old-timers can tell you about the bitter fights between AMers and SSBers in those days, as older amateurs fought change . . . and lost.

DOC's Alien laid it out on the line, and not only for Canadians: "How do we keep amateur radio from becoming extinct? Very simply, you've got to get out there and recruit new interest. Do everything you can to interest young people in ham radio. Advertise. Talk to people. Provide instruction and make it convenient for busy people. Could you convince your local high school to establish an after-school radio club, where a station can be set up? Could you convince school authorities to let you make 'Introduction to Radio Theory' a part of an electronics course?"

Amateurs today buy their equipment and get their enjoyment from using it. Perhaps our entry exams should reflect this reality.

When the first microprocessors became available, hobbyists built their own computers. Then, when commercial microcomputers arrived, hobbyists got busy building accessory boards for them. Soon there were enough users

so just about any board you could imagine was available, so hobbyists turned to software development and hacking. These days computer hobbyists can't hope to compete with mass manufacturing economies or with the humongous commercial software programs, so they're busy playing ever more involved computer games and calling in on computer networks and bulletin boards. There are now over 46,000 bulletin boards in the US.

In amateur radio, though we enjoy reading about building, only a tiny percentage of hams are actually building. There no longer are parts stores in every city. Or in *any* city . . . at least in America. There are some great kits available, but even this activity has dwindled. Maybe you noticed that Heath finally had to give up trying to sell kits, marking the end of an era. And Eico is long gone.

Alas, our license exams still reflect the thinking of a long-gone era. Morse code, which is no longer used commercially in the real world, is still being used as a barrier to keep as many people out of our hobby as possible. Our technical exams are woefully out of step with the reality of amateur radio today. But then even the whole basis and purpose (97.1) for the hobby is out of date, as I've mentioned recently.

No, I don't know how to get the message through to the closed-minded old-timers who are killing our hobby. I hear them at our ham clubs angrily fighting change. I see them epitomized in the good old boys' club in Newington. Let's get some young ARRL directors, for heaven's sake! That doddering old bunch you've elected, still grasping their hand keys to their chests, are leaving deep heel marks in the sands of time as they fight change to the bitter end.

So here we are, fighting over the deck chairs, as our ship, which has collided with the iceberg of change, slowly sinks. Rout the old-timers from your club. If they have tight control, bring in enough newcomers to oust them. You have to be prepared for a fight because the old guard will try to throw you out.

There's an egregious example of this with the Algonquin Amateur Radio Club in Marlboro, Mass. I've written to the president of the club (K1ZFJH) about his outrageous conduct, asking for an explanation. I got a brief note from him saying to contact his lawyer. Further correspondence from me has been ignored. My own feeling, often expressed, is that lawyers are brought into amateur radio matters only by scam. When the homosexual ham group sued QST, demanding their ad soliciting members be run, their strident leader went on my suer scam list.

We can't bring back the days of home construction. We can't bring back CW, other than as a small fun part of amateur radio . . . something some of us do because we enjoy it. We can't bring back AM. My workbench, with shelves of test equipment and a barn full of parts, is a memory. I enjoyed building my first narrowband FM

modulator and installing it in my Meissner Signal Shifter. I enjoyed converting a BC-459 to 20m and adding an NBFM modulator. I loved building my pp813 kilowatt final. I got a whale of a kick out of building my RTTY converter, complete with a dozen or so 6SN7GTxs. But those things are memories and when I'm gone, they'll go with me. Those memories are no reason to try and force today's prospective hams to build their rigs. Or to learn the code.

The SCR-522s which helped stabilize 2m are all gone now. Even my big box of crystals for the rig is gone . . . sold off in an auction almost 30 years ago. But I still remember every detail of that wonderful old rig. And I'll never forget the thrill of making 2m contacts from the top of the New York News building in 1948; the top of the Municipal building in 1949; and the top floor of the Guggenheim museum building in 1951. Or the wonderful RTTY net we had on 2m at that time. Sure, I had to build my own equipment in those days. But as soon as the stuff was available commercially I stopped building, right along with everyone else.

So let's give some thought to where amateur radio is going. Let's talk about what services we can render. Let's stop worshipping the past and trying to preserve it in our rules and tests. If we can't pay back society in some way for the use of our frequencies in the 21st century, we're goners . . . and those old-timers who were fighting you are going to be little more than forgotten Silent Keys listed in the yellowed pages of old QSTs up there in the attic.

Sure, I've had fantastic times in amateur radio. Times I'll never forget. I feel sorry for hams who haven't taken the trouble to do ham things. For hams who've never been on a foxhunt. Who've never won a contest for their section. Who've never made any satellite contacts. Who've never made any aurora contacts. Who've never worked DX on 6m. Who've never mountain-topped on VHF.

I remember sitting in the back seat of my old 1940 Ford on top of Mt. Greylock in Northwestern Massachusetts with my old SCR-522 and a 14-1/2 element beam, making contacts all over New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, and Long Island with three college buddies back in 1947. We'd driven up there one very cold night after a ham club meeting and we had a ball. We swung the beam from inside the car with some string tied to the ends. The beam, tied to the top of my car, had lost 1-1/2 elements on the trip over.

These days all it takes is a tiny HT and I can make contacts through a hundred or so repeaters from any good mountaintop. That was exciting back in 1969, when there were only a few repeaters. I had an old Motorola HT-220 and was able work all over New England with it. My mobile 2m rig got me down to Maryland repeaters when we'd have morning temperature inversions. I hope you're building a lifetime of ham memories.

Oh, my first DXpedition! Wow! That was in 1958 and six of us went to Navassa. I'd gotten KC4AF for our call. I think I may be the only one left out of that group. The others died off or disappeared. I still have some great 16mm film of the DXpedition. But most important are my memories of every minute of the experience. The hurricane during our trip down where we almost ran onto a reef. The time we were almost killed by Haitian police. The pile-ups! The glorious, endless pile-ups. Running out of water. My having to dive in the shark-infested waters to retrieve the beam elements we'd dropped. The heat. The dangerous cliff we had to climb to get to that uninhabited island with no beaches.

My contact with Moscow via OSCAR VII, where we had only a 20-second window to make the QSO.

My wonderful visit to New Caledonia, where I worked the pile-ups for a week and got fabulous pictures of the island from a local ham's plane. And my aerial photos of VK3ATN in Birchip, Australia, and his 2m moonbounce antenna. I used to fly, but I had to sell my plane when I started 73. And my boat, too. And my Arabian horse, and my Porsche. All that went into printing the first issue of 73 back in 1960. Fortunately, the magazine was in the black from the first issue . . . or else it wouldn't be here now. That's the way entrepreneurs are, they gamble everything on a new business.

Many times since then I've not known whether I'd be in business another month or not, but I've always managed to make it.

I remember the first time I worked all continents within one hour. And the weekend I worked 100 countries on 20m phone. And the night I worked all states on 75m AM. Other events may fade from my memory, but my ham experiences stand out clearly, even years later. My nights making contacts with King Hussein in his summer palace. My dinner with him, his wife and in-laws. Working SSTV from Navassa on my second trip in 1973 as KC4DX. Working SSTV from Jordan as JY8AA, and from JY1's station in his downtown palace. Setting up the JY73 repeater in Amman. Working my home station from YK1AA in Damascus, and then again from VK3ATN, where we shifted from 20m to 75m and my W2NSD/1 signal was still S9. The wooden "matress" and cold showers while staying with Father Moran 9M1MM in Katmandu. The friendliness of hams in well over a hundred countries I've managed to visit so far.

My advice to youngsters is to build your ham memories. Do everything you can in the hobby. Amateur radio holds enormous adventure for you if you'll just grab the ring as the merry-go-round turns. My 10 GHz contact with New York State from the top of Mt. Monadnock (NH), where I'd struggled to the top with a three-foot dish, just in case. The top of the mountain was in dense fog, so I had to aim the dish with a compass. Even though my tenth watt signal had to go over a mountain to

make the path, we made a good solid contact. There's no way I'll ever forget that moment. That was my seventh state on the band!

Work DX. Get good at contests. Collect certificates. Get on OSCAR. Do packet, RTTY, and SSTV. Do it all. You'll never regret a minute of it. Looking back on 56 years of hamming, I don't. Perhaps this is why I'm so strident about our coming to grips with change. Why I feel that we need to keep amateur radio in step with the times and not try to keep it a monument to a long-gone past.

Why Democracy has Failed

Yes, I know, if I say white, you automatically say black, so you're going to try and say that democracy has not failed in America. And I say "baloney." I shouldn't have to remind you that the foundation of democracy is an informed electorate. Well, I hope you're not going to try and convince me that a country where less than half the people are interested enough to vote, and most of those who do vote on the basis of sound bites and political commercials on TV, is what our floundering forefathers had in mind when they set up this mess?

They thought they'd set up a citizen's legislature, not a new class of professional politicians whose dominat-

ing goal in life is to get as much money as possible from special interests so they can be endlessly re-elected.

The sorry fact is that there are so many complex problems today that it is completely impractical for the average person to find out what's actually going on. When I signed on as a member of the New Hampshire Economic Development Commission almost two years ago I knew I had a lot of work to do. Well, I dropped just about everything else and went to work. I read every book I could find on education, welfare, taxes, business growth, the international situation, creating jobs, health care, racial problems, crime, our prison system, stopping drugs, and so on. I attended endless committee meetings, have heard testimony from experts on a wide range of problems, and have attended a ton of conferences on exporting, defense conversion, job creation and so on.

Few people have the time and patience to do that kind of research. Yet, without it, how can any of us make informed decisions when it's voting time? How can we write to our representatives to give them our guidance if we don't know what we're talking about? We hear half and quarter truths from most of our politicians. We're at the mercy of political action committees and lobbyists with millions of dollars to

invest in bribing Congress and our state legislatures. It's been well documented that we're getting left-wing bias from our media. So we sit here watching one exposé after another of corruption in savings and loans, banking, housing, defense contracts, health care ripoffs, government land scandals, farm and tobacco subsidies, and endless Congressional pork projects.

To listen to the liberals in Congress, there's no way to cut back on "entitlements." Yet, if they don't, the deficit is going to keep right on growing. Then there's the conservatives who want to set up a virtual dictatorship and control our every move. Phooey.

I Have a Solution!

Yes, I believe democracy is still possible! The electorate can still be informed, and without having to spend two lousy years trying to understand what the hell is going on with the endless messes Washington has created. Well, we're the guilty ones. We're the dummies who elected those crooks. We've let those bozos bamboozle us with emotional TV spots into giving them our checkbooks with all the checks pre-signed. We even elected Charmin' Billy from Arkansas.

So what's the out? Well, one way is to let fools like me do most of the work, digesting the mountains of conflicting

trivia and giving you the results in brief readable form. A digest. And that's what I've been doing with my reports, which are sent to the New Hampshire Economic Development Commission, the Governor, and the Legislature. Each one is 16 digest-size pages long. Reading time is about 15 minutes. I'll be putting 'em on tape for people to listen to in their cars. Each report takes about 20 minutes to read out loud. I put 'em out twice a month.

You can let me do the homework . . . read the books, attend conferences and hearings . . . and tell you (a) what I've found out and (b) offer some creative solutions to the major problems facing us all.

All this can be yours for only \$20 for 20 issues. A steal. Send me a \$20 bill, a check, or your credit card information and I'll get you a bunch of my *Updates*. They'll give you plenty to talk about on the air, that's for sure. And, if you're even remotely inclined to make money, there's a wealth of entrepreneurial ideas in 'em. Send your \$20 to *Updates*, WGI, Peterborough NH 03458-1107. Or fax your credit card info to 603-924-8613.

You'll be able to drive your family and friends crazy by knowing more about just about everything than they do . . . and by coming up with brilliant solutions to the problems. 73

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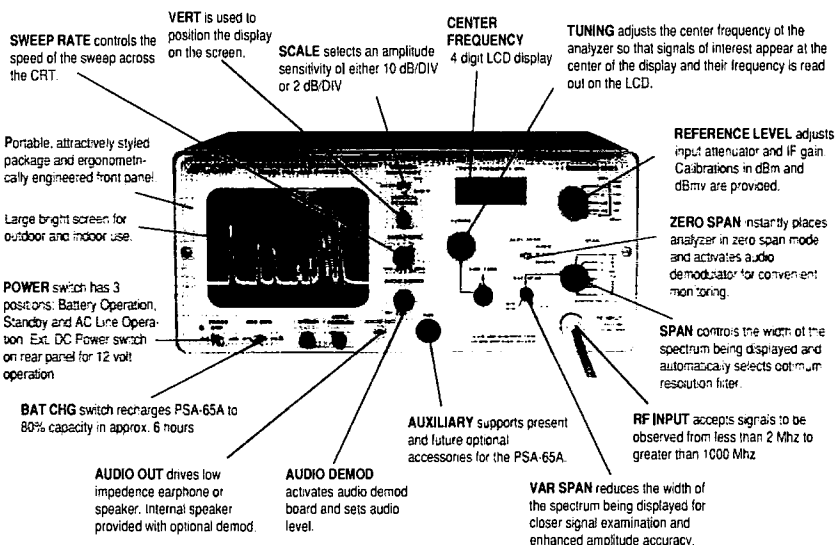
AVCOM's New PSA-65A Portable Spectrum Analyzer

The newest in the line of rugged spectrum analyzers from AVCOM offers amazing performance for only \$2,855.

AVCOM's new PSA-65A is the first low cost general purpose portable spectrum analyzer that's loaded with features. It's small, accurate, battery operated, has a wide frequency coverage - a must for every technician's bench. Great for field use too.

The PSA-65A covers frequencies thru 1000 MHz in one sweep with a sensitivity greater than -90 dBm at narrow spans. The PSA-65A is ideally suited for 2-way radio, cellular, cable, LAN, surveillance, educational, production and R&D work. Options include frequency extenders to enable the PSA-65A to be used at SATCOM and higher frequencies, audio demod for monitoring, log periodic antennas, carrying case (AVSAC), and more.

For more information, write, FAX or phone.



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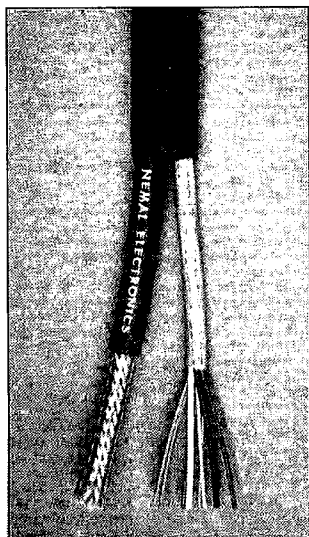
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NEMAL ELECTRONICS INTERNATIONAL

Nemal Electronics International has introduced a new line of composite RF/control cables for use in two-way communications, and especially for amateur radio applications. The "HAM-CABLE" is constructed of a coaxial cable and an eight-conductor rotor cable with an overlay weather-resistant jacket. Available versions include RG8, RG8X, and RG213 for coaxial members with either standard 8C1822 or heavy-duty 8C1620 for rotor control. Part number HC100 consists of RG8 low-loss foam, together with 8C1822 and a black jacket. Other constructions and other colors are available by special order. For additional information, please contact *Nemal Electronics International, Inc.*, 12240 N.E. 14th Ave., North Miami FL 33161; (305) 899-0900, Fax: (305) 895-8178. Or circle Reader Service No. 203.

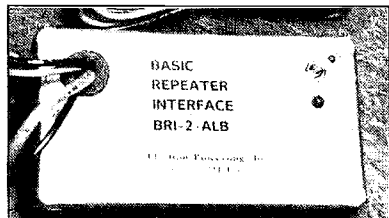
MIDLAND LAND MOBILE RADIO

Digital hams will be interested in this new, built-in two-way radio modem. Midland LMR has introduced an internal modem for its Syn-Tech XTR two-way mobile radios and desktop base stations that provides a built-in data interface. With the internal modem a wide variety of data sources, such as GPS receivers and other vehicle location systems, vehicle sensors, mobile data terminals and PCs, can be plugged directly into the radio.

This integrated radio/modem design optimizes data communications performance and reliability, simplifies installation and saves space; no extra boxes are needed. The modem is capable of data rates up to 9600 BPS, with forward error correction, and supports RS-232 or TTL interfaces. For more information, contact *Midland LMR*,



Marketing Department, 1690 N. Topping, Kansas City MO 64120, or call 1-800/MIDLAND, Ext. 1690. Or circle Reader Service No. 204.



ELECTRON PROCESSING

Hams needing a simple repeater interface that is easy to install and operate can now select a special ruggedized version from *Electron Processing, Inc.* This unit is right for use where either the RF or mechanical environment demand more than a standard enclosure.

The new BRI-2-ALB is housed in a strong cast-aluminum box that is only 2.5" x 4.5" x 1" in size. This new model contains all the features of EP's BRI-2, including a super-sensitive VOX, and both hang and timeout timers. In addition, a rugged transmitter keying relay is included which will handle up to 10

amperes of keying current at 230 VAC or 30 VDC! A passive audio matching circuit assures clean transmitted audio.

The BRI-2-ALB is priced at \$70, plus \$5 S & H. For further information, contact *Electron Processing, Inc.*, P.O. Box 68, Cedar MI 49621; (616) 228-7020. Or circle Reader Service No. 206.

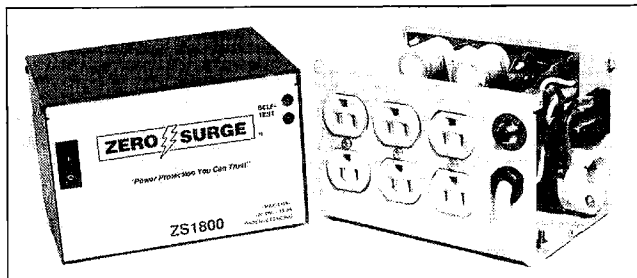
THE TOOL RESOURCE

The Tool Resource has introduced a new No-Clean Wire Solder. The Alpha Telecore Plus No-Clean Wire Solder was developed to meet the highest demands that exist in electronic hand soldering. It leaves only a miniscule amount of optically clear inert flux residue. The development of this product is a result of the shift away from ozone-depleting chemicals that are used in electronics for batch or spot cleaning.

Telecore is a core solder that contains a Water White gum rosin base with an efficient activator system that promotes rapid solder wetting of board pads, component leads and terminations. Although this solder is designed not to need cleaning, it can be cleaned if necessary. For more information



contact *The Tool Resource, P.O. Box 1106, W. Dundee IL 60118*, telephone and Fax: (708) 468-0849. Or circle Reader Service No. 202.



ZERO SURGE

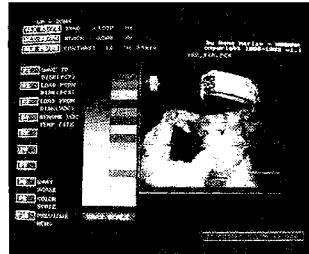
Here is a new patented surge protector that never contaminates ground. The Model ZS1800 surge protector from Zero Surge provides fast suppression of power-line surges to protect microprocessor-based computers, networks, and peripherals. Rated at 15 amps, it eliminates spikes and surges without relying on commonly used MOVs (metal oxide varistors). As a result, this surge protector not only eliminates surges on the 120 volt hot wire but also keeps the power-line ground circuit clean, eliminating diverted surges which MOVs routinely dump onto the ground line.

Experts report that ground-line surges, especially in UNIX and network installations, can cause many

mysterious problems, such as blown peripherals, keyboard lock-up, and lost or corrupted files. Zero Surge products never dump surges to ground, thus eliminating most of these problems before they can ever occur.

Unlike most other products, the ZS1800 reacts to surges and spikes instantly, diverting the surge to a capacitor bank which stores the unwanted energy. The unit gradually bleeds it back to neutral without damaging surge-energy pulses.

The suggested retail price is \$199.95, and this product carries a 10-year warranty. For more information contact *Zero Surge, Inc.*, 215 Glenridge Ave., Montclair NJ 07042; (201) 744-1760, Fax: (201) 744-1804. Or circle Reader Service No. 205.



HARLAN TECHNOLOGIES

Now, a new inexpensive method of copying slow-scan TV from Harlan Technologies uses software and a Sound Blaster compatible sound card with a PC. Slow Scan II will work with the Sound Blaster, Sound Blaster Pro, SB16, Pro Audio Spectrum 16, Fusion

16, and other Sound Blaster compatible sound cards. The program will copy Robot 8, 12, 24, and 36 second black and white, Robot 36 and 72 second color, and Scotty versions 1 and 2. All color modes display in black and white.

Slow Scan II will also re-transmit pictures that were received and can save them either as .VOC files or in the .PCX format. System requirements include a PC with a hard drive, a VGA monitor capable of 640 X 480 / 256 colors, and a Sound Blaster compatible card.

The price is \$40 plus \$5 S & H. (Illinois residents add \$2.50 tax.) For more information or to order contact *Harlan Technologies*, 5931 Alma Dr., Rockford IL 61108; (815) 398-2683. Or circle Reader Service No. 201.

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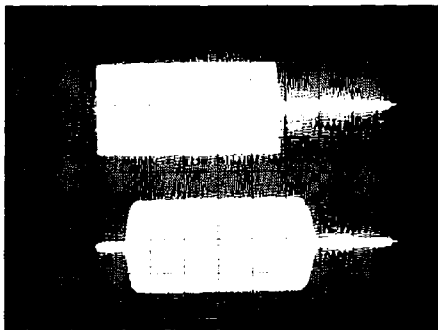
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FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to 73.



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Contract: Congratulations! You have just been drafted by Uncle Wayne and the Team. Your first assignment is to contribute a clear, concise, and complete manuscript for publication. Drop us a line and we'll gladly send you a "How to Write for 73" package. Now get out there and enjoy your hobby. Dismissed.

NEVER SAY DIE

Wayne Green W2NSD/1



Have You Seen *Radio Fun* Yet?

Well, I know the answer. No, you haven't. Because if you had you'd be a subscriber.

I started *Radio Fun* as a way to help the new no-coders get more fun out of amateur radio, and to encourage them to go for their General and Advanced tickets. I wanted them to find out how much fun we're having with packet, slow-scan, fast-scan, our ham satellites, radio clubs, DXing, certificate hunting, building kits, foxhunting, RTTY, emergency nets, and so on. I wanted them to know that amateur radio has a lot more to it than listening to old retired men talk about their illnesses over the local repeaters. Or, as in the case of our Ham-O'-The-Year award winner at Dayton this year, driving everyone within repeater range nuts extolling my virtues and my Horatio Alger success story.

So, how's *Fun* doing? Pretty well.

We've been sending it to every new licensee for about five or six months for free. Why for free? Well, I noticed that *QST* was having surprisingly little luck in getting new hams to subscribe. My idea was to get them really involved in their new hobby while it was new and they were still excited about it. But how many readers could we convert to paying subscribers? That was the key question. You can't give things away free forever.

Thirty years ago, before our mail boxes were as stuffed with junk mail, it was possible to send out a subscription offer for a magazine and get 10-12% of the people to subscribe. These days a 2% response is considered outstanding, with 1% being in the "good" range in the business. With today's postage rates we have to figure at least 60¢ per letter sent out. That's \$600 per thousand. At \$13 for a year's subscription and a 2% response we'd get 20 subscribers and \$260 back for every \$600 we spent. We didn't go that route.

Instead, I decided to let the publication do the selling instead of letters. It costs around \$5 to send five issues, so the question was, what percentage of the readers would pay to subscribe after getting the five issues? That's about the same cost as sending eight letters. And eight letters might, at best, bring in a 16% response. So, have we been doing better than a 16% sale with the free sample route? You bet

we have!

Out of 1,027 expired free subs in January, only three didn't renew! That's right, we got a 99.7% renewal! Nothing like that has ever happened in the publishing business before, so I expect we'll be getting excited write-ups in the publishing magazines. We should check and find out why the three didn't renew. Did they lose interest in amateur radio? Maybe they died?

Radio Fun obviously is terribly addictive. You tried it yet? The subscription price is a ridiculously low \$12.97, though if it gets much thicker we'll have to raise it just to cover the postage. You can give it a try by sending a check for \$12.97, or credit card info, for 12 issues to *Radio Fun*, 70 Route 202 N, Peterborough NH 03458-1107. You can even call 800-257-2346 or fax us at 603-924-9327.

The *Fun* advertisers are delighted. It turns out that my research was right . . . that our newcomers are the biggest spenders in the hobby by a wide margin. They're buying tons of VHF rigs, low-band transceivers, HTs, packet TNCs, antennas, and so on. Wow, are they buying antennas! Indeed, without this new bunch of big spenders, the ham industry would be suffering far more seriously from the recession. Fortunately for our *Fun* advertisers, much of the industry is still stuck advertising in *QST*, so the competition for this bonanza has been low.

\$12.97 may not buy much these days, but it'll get you 12 months of *Fun*.

A Bigger, Fatter 73?

If you'd like to see more pages of construction articles and equipment reviews in 73, that's easy. No, my editorials won't get longer; the additional pages will be used for more articles. Like back in the late 1970s and early 1980s.

How can we do that? The formula is simple: For every extra page of advertising we're able to sell you'll get an additional page of articles. So how can we attract more advertising? Your complaining to the advertisers might help a little, but probably not much. They advertise in the magazines claiming the highest circulation. So, if we have 65,000 paid readers and *QST* has 130,000, that's where most of the ads are going to go.

How come *QST* has double our circulation? And what, if anything, can be

done about it? Well, 73 was doing fine until I had to sell it 10 years ago.

I'd started a bunch of computer magazines back when the microcomputer industry was just getting started. Eventually the megapublishers with deep pockets came along and offered me a choice of selling my magazines to them or going out of business.

I got the best offer I could for my entire publishing company. That left me with no way to publish 73, so that went along with the computer magazines and I had to start all over again to build a new publishing business. It took a while before I had a big enough organization to be able to take back 73. By that time the computer publisher had come close to killing it. The circulation was down to half, and so was the advertising. There were an awful lot of disgusted ex-readers and angry ex-advertisers. And once you make customers mad they are incredibly difficult to ever get back, so we've been kind of limping along at half strength ever since.

I made a deal to publish 73 on contract, as a way to save it. I put my editorials back in and increased the construction projects and equipment reviews. Then, last year, I swapped *CD Review* for 73 and finally got back the ownership. Now I'd sure like to get it growing again and make it the biggest magazine in the ham field . . . the way it used to be.

If every subscriber would get just one other ham to subscribe, we'd really raise hell with *QST*. Once we have even close to their readership we'll get plenty of advertising and be fatter than they are. All it takes is circulation. Many advertisers aren't happy with *QST*, but it's got the largest circulation.

Subscriptions to 73 are \$20 a year, so if you can get at least one other ham to send us \$20 for a subscription, I'll have one whale of a magazine for you. One without all that baloney club news which fills so much of *QST*.

We are, by the way, the only ham magazine which has Audit Bureau of Circulation certified circulation numbers. The others we have to trust that they're not . . . er . . . being generous in their circulation estimates. But then, they wouldn't lie, would they? Not just to get more advertising dollars from gullible advertisers. It would never even occur to me to accuse my esteemed publishing colleagues of such villainous perfidy.

By the way, while it's a no-no for me to go on the air and solicit 73 subscriptions, there's nothing to prevent you from bringing up the subject when you run out of more important things to talk about . . . if there are any. It sure beats those old tired weather reports and cliché recitals of your equipment and antenna model numbers. If enough readers keep mentioning the magazine, it'll gradually begin to seep into even a few of the denser consciousnesses.

Your reward for all this? Firstly, I can assure you that you will be richly rewarded in heaven. I have connections. Secondly, you'll start having more magazine to read. A lot more. And the more stuff we have, the more fun you'll have reading it. We might even get your juices going and get you off dead center and into satellite communications or something.

That Lap of Luxury Deal

There's this myth about Wayne living in luxury on the enormous profits from 73. Har-de-har. Oh, I can't complain . . . but that's because other ventures have done well. Ask anyone who knows me and you'll find that NSD stands for never spend a dollar. I'm cheap. And whenever I do manage to end up with some money I quickly invest it in a new venture, thus getting rid of it.

I think I mentioned that Sherry and I spent a week in Rome in April this year. When you're rich you can travel, right? Well, it turns out that the more you can get your business to charge things on a Continental Airlines Master Card, the more free trips you can take. Our week in Rome, complete, cost \$551. Fine hotel, great meals, sight-seeing everything, the works. You don't have to be rich, just smart.

Sherry has had three extravagant things she's wanted us to do. Her how-to-dance videos have been doing well, so she's arranged for us to fly to London on the Concorde, spend a week, and come back on the QE2. Maybe next year we'll do the Orient Express.

We'll be leaving Dec. 9th, in case your wife has some extra money stashed away and you'd like to join us. We get back the 19th. There's a special combo price, so it's a way to get in two big events in one trip. Your wife won't forget it. Heck, neither will you. I did a Concorde trip 10 years ago and I still remember every minute of it. I'm still using the Concorde playing cards to play cribbage. And win. Nobody beats me at cribbage. Nobody.

If you're interested let me know and I'll have Sherry get you the details. It'll be even more fun if we've got some friends like you along.

Are You a Dreadful Bore?

I'm still getting endless letters complaining about how boring most ham contacts are. They're not talking about *you*, are they? When's the last time, when they were signing off, that someone told you how much fun they'd had talking with you? Will they give you a call the next time they hear you on the air? Do other chaps break in at the end of a contact to tell you they've been listening and enjoying it?

Continued on page 74

From the Hamshack

Keith Bruno KC4ZV, Orlando FL
Wayne—Your last issue of 73 inspired me to finally take some time out of my schedule and write. Let me first state that you have a fine magazine and it is the best amateur radio publication in existence, hands down. I have read them all, but have only kept up my subscription to yours.

I agree with almost all of your opinions, especially those relating to the farce called government. Most of your ideas for change are very logical. Unfortunately, that is precisely why the government will probably never listen to them.

You are always bashing the educational system of our "fine" country and I would like to further reinforce that opinion. I am a product of our poor educational system. I graduated from high school in 1983, nowhere near prepared for the real world. I can honestly state that I was bored with most of the subjects in high school, except for computer science. Luckily, I got a great job right after high school working for the world's largest defense contractor and had some great opportunities to pursue my first love, computers (my second being amateur radio).

I have to say, though, that if one wants an education, it is out there. Ninety-five percent of everything I have learned about computers, and ninety-nine percent of what I have learned about amateur radio I have learned on my own. Right now I am enrolled in the NRI course for Radio Electronics and hope to get my General Radio Telephone Operator's License. There is no one who is responsible for my education and my well-being except me. I hate it when people grumble about how they never had a chance, or that the world owes them a living. Baloney! Get out there and get yourself an education. Stop complaining about your life and do something about it.

My wife is always making fun of me. I am 27 years old now and always seem to get involved in what she calls "old men's hobbies." It is a shame, but at the club meetings I go to almost everyone is over 40, with most of the guys in their 50s. I may see one or two kids, but that's it.

And as for offering any help, forget it! No one, not even the local amateur radio shop, is even helpful. As a matter of fact, they all seem to have this attitude that if you don't already know, then they are not going to take the time to explain it. Pitiful!

I have taken your advice to try something new and have gotten into packet. Again, I had to dig through the manuals and call the manufacturer to figure out how to connect it to my computer and radio. I want to figure out how to link my two computers together with some software like PC Anywhere. I figure if they can do it over the phone, then I should be able to do it over the radio.

I have a no-code Technician license. I got it before they even had a formal no-code test, about two months after they came out with it. I do not plan to upgrade until the code requirement is dropped. I really have no desire to ex-

change call signs, QTH, and a signal report with some old guys who have never done anything but pound on those brass keys. Heck, if I need CW to "punch through" in bad conditions, I'll hook up my multimode controller and type on the keyboard and let it send CW.

Adam Halle NØVCL/AE, Sterling OH
Wayne—I am writing in response to your editorial in the May 1993 issue of 73. You were right about schools. I am 14 years old and I am home-schooled. We are wrapping up our second year. I have enjoyed homeschool very much. These two years have gone by faster than any two years in public school.

For science (up until April of this year), I studied radio and electronics theory. I began studying for my Technician Class license in October 1992. On April 6, 1993, I upgraded to Extra Class. While getting school credit, I did something I enjoyed doing. I could not have done this in public school. Now I have gotten my dad interested in ham radio and he is studying for his Technician license.

Also, I agree with your editorials on EMR. Keep up the good work. Your ideas are very good, and they get better as more research is done on this subject.

Bruce Williams N9JCV, Lake Villa IL
Six months ago I purchased an ICOM 728. I love it. I had a problem with it (the preamp went out). I sent it back to ICOM for warranty repair and it was back in my shack two weeks after I sent it away.

Yes, I bought a kit also. I purchased a Ramsey 30m transceiver, spent three hours putting it together, and it works like a charm.

I used to work all SSB, 100 watts. I got my WAS, WAC and DXCC (applied for). I am now very interested in QRP operation and building. By the way, 73 does a great job supporting QRP endeavors. I think everyone should cut their power by 50%. What nicer bands we would have.

Wayne, I don't agree with everything you write, but I always read your column from front to back as soon as I get 73.

Oh? What in hell don't you agree with? . . . Wayne

Bill Eaton N9OTZ, Elgin IL
Wayne, along with so many other hams, I enjoy 73. The deciding vote for 73 vs. CQ or any other publication is your editorials. It's so refreshing to hear intelligent, well-thought-out ideas and viewpoints. Of yet I've found no point of contention, although I suspect we may differ on religious ideas.

In January 1992, my partner (I'm a paramedic) was browsing through a handie-talkie sale pamphlet. "Neat looking scanner," I said. From that point on my understanding of ham radio as a bygone hobby of yesteryear, consisting of an oversized, tube-operated transceiver, a Morse code key and an antenna that made neighbors nervous, has changed. I was licensed in March and

have loved the hobby. I've met many hams, all of whom have confirmed my pastor's comment of ham radio as "a gentleman's hobby." From these meetings I've seen everything from 20 meter DX to ATV balloons and ATV with the shuttle spacecraft! Needless to say, this keeps my motivation alive to upgrade and expand. The only thing that holds me back is time and money (not necessarily in that order).

Frustrations? Yes. The pathetic lack of any substantial, in-depth conversation. On my attempts to initiate such, the normal response is, "Oh, that's interesting . . . Well, what kind of radio are you using?" or "How's the weather?" Once in a while it works, though.

Here's a new thought on the service/hobby issue: Any hobby that requires initiative and learning, that may lead one to higher education, etc.—keeps kids off the street!—is a service. It may lead someone to your editorials and get them thinking. Now, that's service!

Now for my pocket review: the Yaesu FT-415 2 meter handie-talkie. After a year and a half of almost daily operation, the only problem I've encountered so far is that the click stops on the frequency dial quit clicking and stopping. My dial began to turn freely, scooting up and down frequencies with annoying speed. Being an excited newcomer to the hobby, I bypassed factory service and fixed it by slipping a small plastic tube over the dial post and replacing the knob. This makes for a nice snug dial which still functions well. I've always received good reports on audio quality. A fine feature of most handie-talkies is that your hand gets burned if you talk too long, keeping a check on the motor-mouth syndrome.

Fixing things yourself? What are you, some kind of troublemaker? . . . Wayne

Richard Monjure, Covington LA
Wayne, I see comments about other hams in your column. There are all kinds of people in radio, and they talk about varied topics. Topics such as racial separatism, homosexuality, politics, etc., are offensive to some, but there is a bigger issue involved. That is "Freedom of Speech," which is in our Bill of Rights and in the Communications Act of 1934. So, as unpleasant as certain topics are, I would not shut up those who discuss them as long as they operate according to the radio regulations.

I make my living in radio. I know the limitations of CW, but it is still possible to send a telegram via CW, despite what some writers in ham radio magazines say. A large portion of the world's merchant ships still use CW. The reason many hams cannot accept this is that so very few hams really understand CW.

If you cannot copy 20 WPM you cannot expect to handle traffic efficiently on manual Morse circuits. The ability to receive code using a typewriter is also a requirement. You hear hams who say they copy "words, not letters." Come on! You cannot copy that way and expect to have the accuracy required for traffic handling.

The professional CW operator must have readable sending at a good speed. Automated keying is a must, unless you are good on the key. What do you hear on the ham bands? Operators who equate skill with speed. They send faster than they are able to legibly

transmit and wind up having to correct nine out of every 10 words they transmit.

What is the point of all this CW talk? The vast majority of hams cannot work CW due to lack of skill and understanding of that very mode. Extras Included. Any ham radio operator who wants to work CW should pass a real code test and have a CW endorsement on his license before he is allowed to operate on the CW bands. I believe CW is limited compared to modern data methods, but it has its place.

Which leads me to the question of no-code licenses. I do not feel code ability should be required for ham radio operators not operating CW. In my opinion, all the different license classes are not necessary.

An entry level amateur radio operator test should cover theory on the basics because everyone needs basic knowledge to build on. Past that, the test taken should depend on which mode of communication you plan on using.

Operators should understand the circuitry, bandwidths, etc. used in their mode of choice so they know how to use it properly on the air within the technical regulations set forth by the FCC. It is too bad the testing is not directly in the hands of the FCC anymore. I see no problem with a \$35 license examination/renewal fee.

I think it is terrible that anyone can buy books with the exact questions and answers to the amateur exams in them. That should be stopped. Whatever rule has to be changed should be changed to end this cheating.

I do not think the UHF frequencies are so important to ham radio. Some should be available to experimenters, but the ham radio role as a back-up communications system I think is a natural for the HF range. Most commercial communications, except for Maritime Mobile, have abandoned HF in favor of satellite communications. Hams could be a natural to fill this "void." The new digital modes make this feasible.

Richard—I'm not aware that I have suggested a limitation on discussion subjects on the air. I am opposed to the use of bad language, even though that is protected by the Constitution. It isn't necessary to offend people. As far as religion and politics are concerned, I like Glasgow's quote: "The fewer the facts, the stronger the opinion." I enjoy talking politics and religion on or off the air, as long as I'm talking with a thinking person and not a zealot.

Fine on CW. But why bother testing the code when someone using it has to be able to copy to do it? That's self-testing.

The microwave ham bands probably won't be a problem for long. Satellite bands are going to be in such enormous demand that we'll lose 'em all fairly soon. Too bad. It would be fun to have a ham satellite system which would allow an unlimited number of us to communicate anywhere in the world 24 hours a day. With spread spectrum, this is possible. There's an outfit here in NH developing just such a system. It'll make it possible for any car, truck, boat, ship, etc., to be in constant communication anywhere with any fixed or mobile stations with voice or data. I doubt there'll be much more of a need for ham emergency services once this gets going. It's a kind of super cellular telephone. Cheers . . . Wayne

FCC Relaxes Business Restrictions

The Federal Communications Commission has enacted a major change in the law restricting amateur radio use for personal business and public service. Under the new rules, it will no longer be a violation to order a pizza or make an appointment via amateur radio. The Commission has acted to amend the Part 97 Amateur Service rules allowing for more flexibility in personal business and public service communications.

The amendment permits licensees to use the amateur service frequencies to assist with public service communications at races, parades, and educational activities. Personal communications which will no longer be prohibited include making appointments, ordering food, and collecting data for the National Weather Service.

Effective 30 days after publishing in the Federal Register (approximately September 15th), here is what you can do (with some exceptions) on the ham bands:

Any amateur-to-amateur communications are now permitted unless:

- a. Specifically prohibited. These include:
 1. Music (except for incidental space shuttle music);
 2. Communications facilitating a criminal act;
 3. Messages obscured by codes or ciphers;
 4. Obscene or indecent words or language; and
 5. False or deceptive messages, signals, or identification.
- b. Transmissions for compensation. The following exceptions apply:
 1. Morse code practice and information bulletins (special criteria);
 2. Classroom teachers using ham radio in the classroom.
- c. Transmissions for the pecuniary benefit of the station control operator or his or her employer.

The following communications are permitted, but not on a "... regular basis" (not defined by the FCC):

1. Communications which could be reasonably furnished through other radio services;
2. Notices concerning sale or trade of amateur station apparatus; and
3. Retransmissions of government provided space shuttle, propagation, and weather forecast broadcasts.

Here are some examples of the old and new part 97.113 which covers prohibited communications:

OLD RULE: No amateur station shall transmit any communications which promotes the business or commercial affairs of any party. If anyone profits financially, it is an illegal transmission.

NEW RULE: An amateur may not be paid, direct or indirect, for his voluntarily provided

communications.

OLD RULE: Except for emergency communications, the ham bands may not be used as an alternative to other authorized radio services.

NEW RULE: Amateur-to-amateur communications which could reasonably be furnished alternatively through other radio services will now be permitted on the ham bands—although not on a regular basis. This will allow amateurs to legally participate with the Weather Service, police and fire departments, parks and forestry service, and many other local, state, and federal agencies. *TNX Westlink Report, No. 654, July 29, 1993, and W5YI Report, Issue 16, August 15, 1993.*

Technician is Hot Ticket

The Technician Class amateur radio license is maintaining its accelerated growth rate of 20%—by far the fastest growing ham class. Before 1991, amateur radio overall grew at only a sluggish 3% rate. Today, that figure is a healthy 10%. If the rate of growth of amateur radio continues on the track it's on now, we will surpass one million licensed ham operators by 1998.

In 1985, only one amateur in five was a Technician. But since the arrival of the Codeless Technician Class in 1991, the demographics have shifted significantly. Today, one third of all hams are Techs. *TNX W5YI Report, Issue 13, July 1, 1993.*

2 Meter Transmitter for AMSAT Phase 3D

The AMSAT Phase 3D Satellite will don a snappy new 2 meter transmitter, designed and built by Mike Dosett G6GEJ. This task will be undertaken as part of AMSAT-UK's participation on the international project team. Mike described his proposed design at the recent AMSAT-UK Colloquium held at the University of Surrey in England.

Together with the 70cm uplink receiver being constructed in Germany, the AMSAT-UK-supplied 2 meter transmitter forms a mode UV station, (also known as Mode B on OSCAR). Current users of Mode B on OSCARs 10 and 13 can look forward to better performance with the launch of the new bird, slated for April 1996.

Calling All Home-Brewers

The Radio Amateurs of Canada are making a call for papers for the Technical Symposium of their First National Convention. Papers concerning both the technical and practical aspects of ham radio are welcome. Subject areas include: HF, VHF, and UHF communication methods and techniques, packet, AMTOR, RTTY, AMSAT, and EME.

The papers will be featured in a 30-45

minute presentation and a 15-minute Q & A session with the audience. They will also be printed in the Technical Proceedings of the First National Convention of R.A.C.

R.A.C. Convention '94 will take place in Calgary, Alberta, Canada, July 29-31, 1994. For further information please contact: G.W. (Gerry) Shand VE6BLI, 55-51551 Range Road 212A, Sherwood Park, AB, T8B 1B2 Canada; (403) 922-2099, FAX (403) 438-4398.

Clinton is High on Hams in Space

The president of the United States, no less, took time out of his busy schedule recently to extol the virtues of the Shuttle Amateur Radio Experiment (SAREX) program. While talking to the STS-57 mission astronauts on a special hookup, President Bill Clinton said: "I understand that later in the mission Janice (Voss) and Brian (Duffy NSWQW) are going to be talking with schoolchildren around the world. I just want to tell you how much I appreciate the fact that you're making an international education project out of this mission. That's very important to me."

Astronaut Brian Duffy responded: "Mr. President, we find that using amateur radio is an excellent way of communicating with children all around the world, and we're also able to excite them by using space and science."

President Clinton concluded: "You may be on this mission, creating thousands of scientists for the future just by the power of your example and by this direct communication. I think sometimes we underestimate the impact that human contact in an enormously impressive setting like this can have on children across the world—not only those with whom you talk, but millions of others who will just see it and know that it happened." *TNX Westlink Report No. 653, July 15, 1993 and W5YI Report, Issue 13, July 1, 1993.*

Alkaline Batteries Rise From the Dead

Look out NiCd's (nIcads)—technology has given new life to spent alkaline batteries. Until recently, alkalines were considered throw-away types. Now Rayovac Corporation has unveiled an improved alkaline cell and recharger combo that blends the advantages of alkalines with those of NiCd's.

The low cost *Renewal* battery comes fully powered and ready to go. Rayovac says it lasts up to three times longer than a NiCd when new—however, the cycle-hours decrease to about the same as a NiCd after about 25 charges. The new battery also can hold a charge for five years (compared to three months with a NiCd) and shows no susceptibility to the dreaded memory effect of NiCd's. *TNX Electronic Products, No. 3, August, 1993.*

More Gadgets for Your MFJ-9020

Add features to this great QRP rig.

Robert W. Vreeland W6YBT

Like many hams, I just can't leave ham radio at home. The ideal traveling station should be lightweight and compact and should also have sufficient power for use with indoor antennas. The MFJ-9020 is the ideal basic building block for such a station. I have added an extra audio amplifier, some keying modifications and a lightweight power supply. For hotel room use, I built a short inductively-loaded dipole and a 20 watt amplifier to drive it.

Although the MFJ-9020 audio is quite adequate under normal conditions, some hams may want a little more volume. Therefore, I've added an LM380N amplifier using the circuit provided by the manufacturer (Figure 1). The LM380N has a gain of 50 but I wanted a gain of 10 so I added a five-to-one input divider consisting of a 22k resistor and a 4.7k resistor. The 0.02 μ F capacitor rolls off the high frequencies to reduce noise.

Photo A shows the method of mounting the amplifier using the MFJ speaker mounting screws. The original mounting nuts were left in place to serve as spacers, providing adequate clearance between the circuit board and the cabinet. Note that the

circuit board has been cut to fit the contour of the speaker. The strange tunnel on top of the LM380N is a sheet-copper heat radiator, grounded and soldered to pins 3,4,5,10,11 and 12. The white wire was disconnected from the speaker and reconnected to the amplifier input. The amplifier ground was connected to the speaker and to the original brown ground wire. Of course, I connected the amplifier output to the free speaker terminal. Power for the amplifier was taken from the two rear terminals on the MFJ power switch. The amplifier is used only with the loudspeaker. I have found that my old 2000 ohm Telex earpiece works much better than the earpieces designed for 8 ohm outputs.

The MFJ keying, although crisp and clean, was a little bit too solid for my taste so I decided to soften it, as shown in Photo B. This was done by bypassing to ground the output of the 78L05 regulator (U8), using a 47 μ F capacitor in parallel with a 220 ohm resistor. A 1N4005 protective diode was connected across the 78L05 as shown in Figure 2. This modification was done without drilling any holes and without removing the MFJ circuit board. The regula-

tor (U8) is located at the left near the front of the circuit board. I very carefully soldered a piece of #26 hookup wire to the regulator output lead on the top side of the circuit board. (A voltmeter was used to locate the 5 volt output lead.) The other end of this wire was connected to a terminal strip which I mounted on the MFJ antenna connector using one of the existing mounting screws. The 47 μ F capacitor and the 220 ohm resistor were then mounted on this terminal strip.

The manufacturer has thoughtfully provided a circuit board trace bringing the keyed 12 volt supply out just in front of the relay. The 1N4005 was connected between this point and the terminal strip. The keyed 12 volt bus was also brought out through a 100 ohm 1 watt resistor. This was connected to a red pin jack mounted in one of the unused holes on the rear panel. The jack is used to control my 20 watt amplifier for semi break-in.

The RF amplifier uses a pair of 600 volt Supertex VN0660N5s (Supertex Inc. 1225 Bordeaux Dr., Sunnyvale CA 94088-3607). High-voltage MOSFETS are nice because they can be powered directly from the recti-

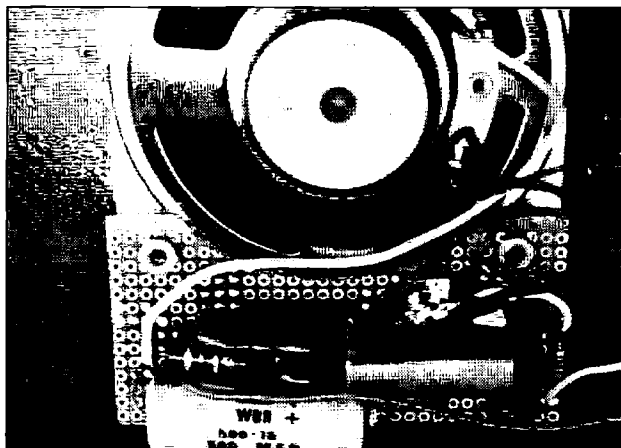


Photo A. The audio power amplifier was attached using two of the original loudspeaker mounting screws. Note the tunnel-shaped sheet-copper heat radiator at the lower right. It is soldered to the LM380N.

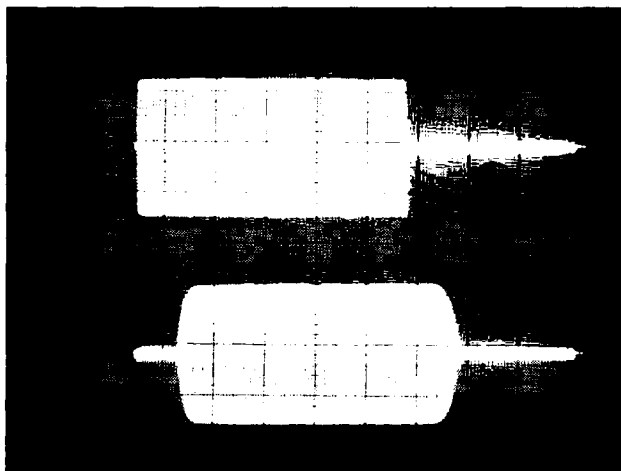


Photo B. A double exposure showing the keyed RF envelope before modification (above) and after (below). The horizontal time base is 5 milliseconds per division.

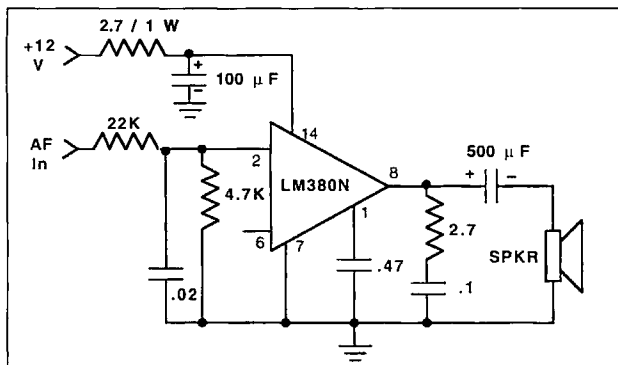


Figure 1. An extra gain of 10 was provided by this audio amplifier.

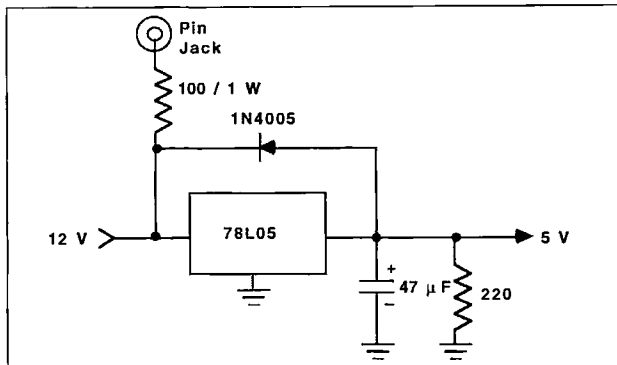


Figure 2. Keying modifications. The pin jack controls the 20 watt RF amplifier for semi break-in.

fied and filtered 120 volt line without the need for a step-down transformer. The amplifier was built into a 4" x 6" plastic card-file box. Radio frequency transformers are used for the input and output to keep the high voltage inside where it belongs. High-voltage MOSFETs have been improved considerably in the last few years. Our amplifier runs at 50% efficiency and will withstand moderate antenna mismatches, but that is a subject for another article. A general discussion of high-voltage MOSFET amplifiers was published in *RF Design* (Vreeland, R.W.: "An Ultra Light-Weight Transmitter Using High-Voltage MosFets," August 1985, pp. 46-50) and in *QEX* (Vreeland, R.W.: "Notes On a Light-Weight Portable CW Transmitter With a Transformerless Power Supply," June 1988, pp. 11-13).

Add a Dipole

The station (Photo C) was completed by the addition of a 12 volt regulated supply (Edlie TE626-24; Edlie Electronics, 2700 Hempstead Turnpike, Levittown NY 11756-1443). Did I say completed? Well, not quite. What good is a station without an antenna? And how do you fit a half-wave dipole into a hotel room? The obvious answer is the inductively loaded dipole shown in Figure 3. The coils are wound on sections of 1-1/16" outside diameter PVC water pipe using Archer 278-1218 #22 gauge hookup wire. The method of anchoring the wire is shown in Figure 3. The wire was threaded down through one hole and up through the adjacent one. I fed the dipole through a 22-foot length of RG-58/U (Archer 278-971).

Tuning was done by adjusting the lengths of the end sections. A bowline was tied in each end to form a loop for supporting the antenna. The end sections for my antenna are 38 inches long as measured to the outer end of the loop. It is best to start with at least 42 inches of wire to allow for pruning. I have found the MFJ-207 SWR Analyzer to be indispensable for this purpose. When properly tuned the antenna will cover the entire tuning range of the MFJ-9020. The antenna should be mounted in the clear. Metal lath walls will cause detun-

ing, as will aluminum-backed insulating material.

The question of the possible existence of non-thermal RF health hazards has not yet been answered. Until it has, it would be best to hang the antenna a reasonable distance from the operator and to refrain from running high-power. As a former 75 meter AM mobile operator, I have been exposed

to moderate RF fields without noticeable ill effects. For this reason I take a fairly casual attitude toward moderate RF exposures. However, you should make your own decision. In these days when intelligent people worry about exposure to 60 Hz magnetic fields that are only one one-hundredth as strong as the magnetic field of the earth, how careful can you get?

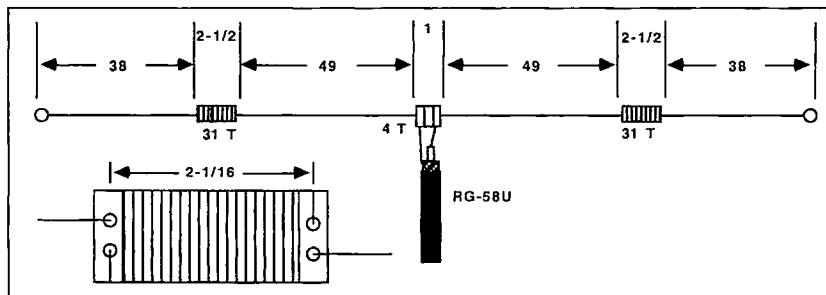


Figure 3. Hook-up wire and PVC water pipe were used to construct this portable antenna. All measurements are in inches.

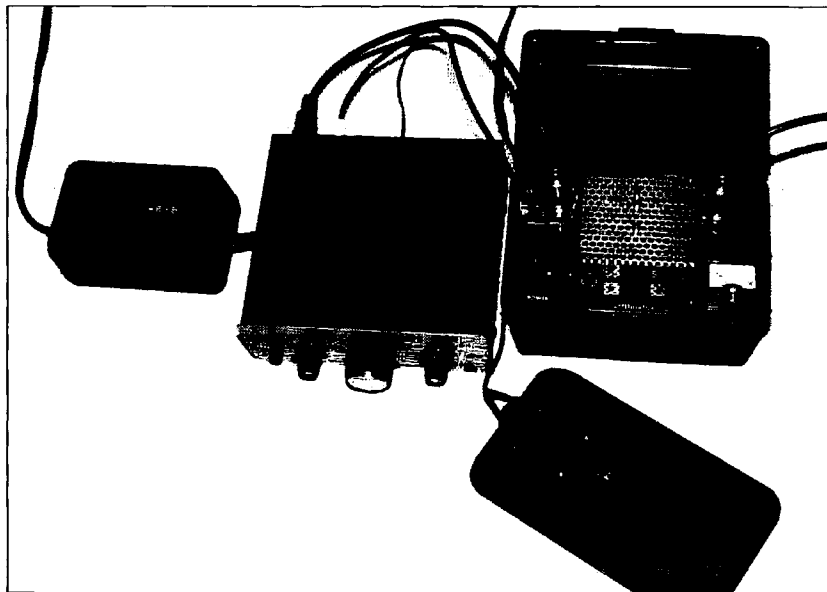


Photo C. Ready to go. The portable station was completed by the addition of a two-pound power supply (left) and a two-pound RF amplifier. Note the old reliable J-37 key mounted on a piece of circuit board.

Universal Automatic Minimum Power Control for AMTOR

Use just enough punch to get the job done.

by Ed C. Miller N7APE

Most of the digital communications in the ham bands is done at whatever power setting the operator chooses. I am sure most hams would prefer to operate at the minimum power needed, but with AMTOR it would require virtually constant adjustment.

The circuit described here was inspired by the automatic power control (for AMTOR) unit developed by Carl D. Gregory K8CG. It was designed for use with transceivers using external voltage control power adjust. The circuit presented here is for use with *any* SSB transceiver being used on AMTOR. It senses the same TNC signals as Carl's circuit, but uses that information to adjust the TNC audio level to the transmitter—and thus the power output. If no error signals are detected by the TNC, the transmitter power will be gradually reduced until an error is detected. It will then increase the output power level until no errors are detected. Thus, the transmitter power output will generally be at the minimum level necessary for reliable communication, meeting the FCC's requirement.

Although this circuit was designed for use with an AEA PK-232 TNC, it should be

adaptable to other units with only minor modification. And, because it controls the transmitter audio level, it should work with any SSB rig.

The main unit is on a small circuit board mounted inside the TNC. It interprets the error signals from the TNC. Its input includes ground, +5 volts, and the outputs of four of the TNC LED drivers, one of which enables the power control feature in the ARQ mode. All of the digital activity is conducted on this board. Its output consists of one shielded two-wire cable that plugs into the power control section, which is an L-pad with an FET for the output leg. This pad is connected between the TNC transmit audio and the transmitter audio input. One wire provides initial bias to the FET, and the other the control voltage to the gate of the FET. With this installation, no traces are cut, so the TNC can easily be returned to its original condition.

Control for this circuit is provided by the indicator driver ICs. If the TNC is in AMTOR mode, whenever an error is detected the RQ, PHASE, or OVER indicator driver is enabled. The voltage at pins 12 and 13 of the 4093B goes negative, which in turn causes pin 3 to also go negative. C5 is

gradually discharged, increasing the negative bias on the gate of the FET, reducing the loss in the T-pad consisting of R_a and the FET impedance. This increases the audio level to the transmitter, increasing its power output. When the power is raised to the point where no errors are detected, NAND Gate 2 will go positive, and the transmitted power will begin to gradually reduce. This constant automatic control of the RF output allows AMTOR usage at the minimum level necessary for reliable communication.

In any mode except AMTOR, the ARQ LED will not be lit, thus pins 5 and 6 of the 4093 will rise to +5 volts. Pin 4 will go negative, quickly discharging C4 and increasing the drain to source impedance of the FET to a very high value, causing minimum loss in the T-pad. This sets the transmitter output power to maximum in all modes except AMTOR.

Construction

The layout and construction of the main board is not critical. It can be mounted with metal brackets, using the two main board mounting screws. Care in mounting is important to prevent damaging the TNC board. Remove the bolts, then insert them in the

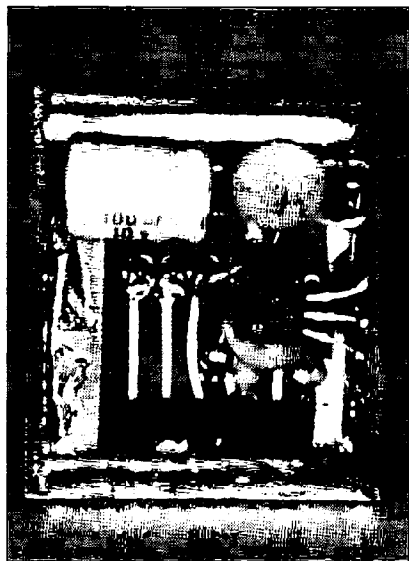


Photo A. Audio control unit (with cover removed).

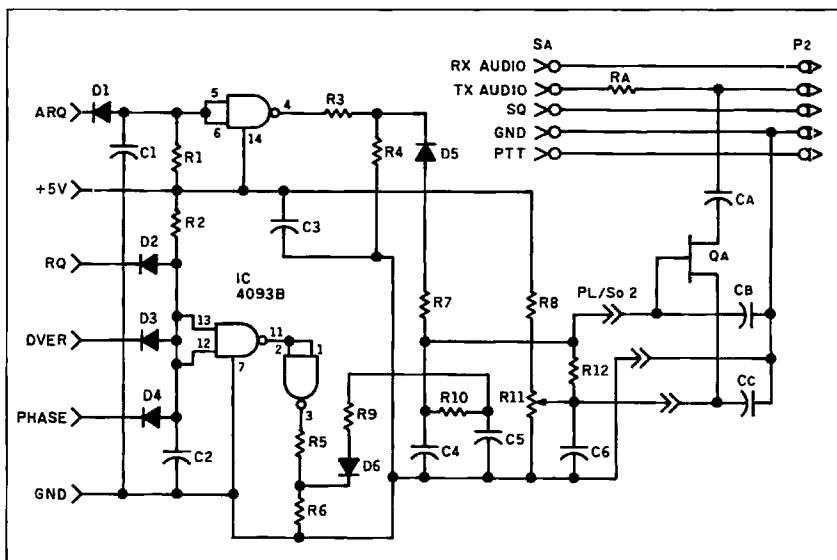


Figure 1. Schematic diagram.

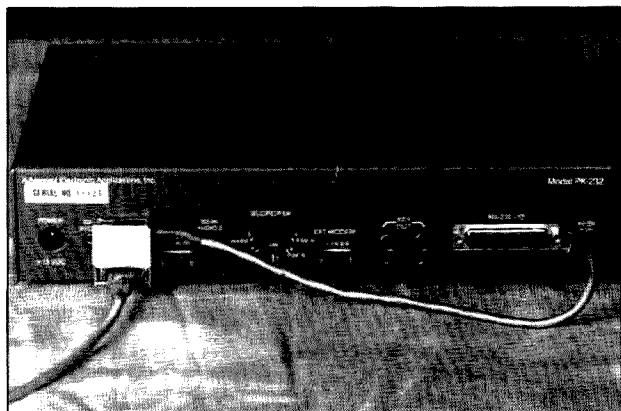


Photo B. TNC rear view with unit installed.

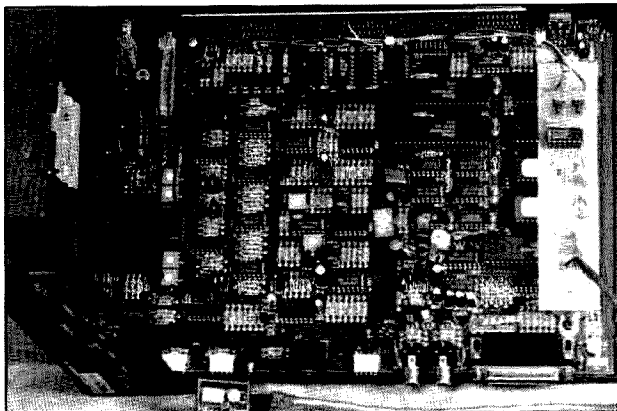


Photo C. Suggested main board mounting.

mounting brackets. Place a mica (or other insulated) washer over the front bolt, and a small metal lock washer over the rear bolt, before re-inserting the bolts. *These washers are important* in preventing damage or the introduction of a short in the TNC board, and to provide its case ground connection.

The four status sensor wires are most easily connected to the appropriate LED negative connections on the indicator board. Extreme care should be used in making these connections as some of the LEDs have PC board traces very close to them.

The T-Pad unit was made of one-sided PC board, with a metal cover. It plugs into the RADIO 2 connector on the rear of the TNC, and the RADIO 2 cable plugs into it. This compact design and layout minimizes RF interference; however, it does require a steady hand and small tools for its construction. Of course, it is not necessary to have the cable-connector assembly made in a cable-end configuration. It would work equally well in

a small metal cabinet, with the male connector on it and a suitable cable to the TNC terminated in a five-pin female header.

Only one adjustment is required for setup: With the TNC operating in *any mode* other than AMTOR, adjust the trimmer resistor for

maximum audio output to the transceiver. It should be set just to the point where maximum audio output is reached.

In AMTOR mode, this unit will provide an output power-control range exceeding 20 to 1.

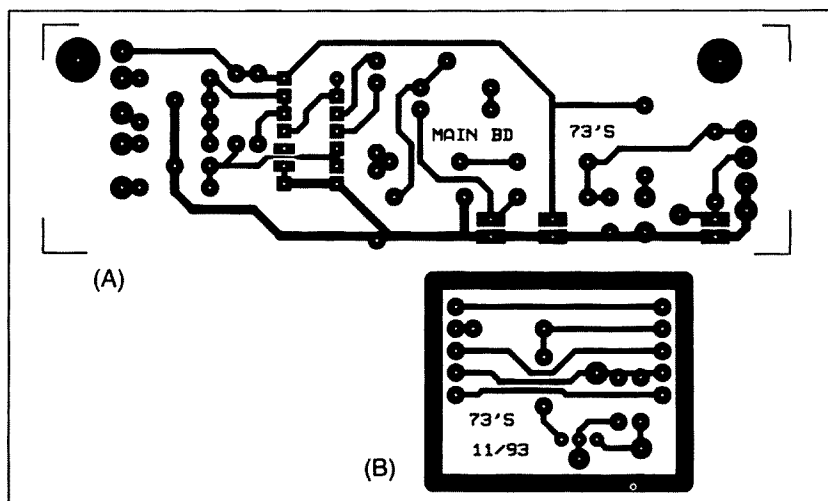


Figure 2. a) Main unit PC board pattern; b) Audio unit PC board pattern.

PARTS LIST Main Board

D1,D2,D3,D4,	
D5,D6	1N914 Si Diodes
C-1,C-2	180 pF poly capacitors
C-3	10 μ F 25 volt electrolytic capacitor
C-4	0.1 μ F 15 volt ceramic capacitor
C-5,C-6	47 μ F 25 volt electrolytic capacitor
R-1,R-2	15,000 ohms carbon 1/4 watt
R-3,R-5,R-8	470 ohms carbon 1/4 watt
R-4,R-6,R-7	4,700 ohms carbon 1/4 watt
R-9	2,200 ohms carbon 1/4 watt
R-10	22,000 ohms carbon 1/4 watt
R-11	1,000 ohm trimmer potentiometer
R-12	1 megohm carbon 1/4 watt
IC 4093B	Quad dual NAND gate

Cable Connector Board

Ca	100 μ F 10 volt electrolytic capacitor
Cb,Cc	0.1 μ F 15 volt ceramic capacitor
Qa	2N5457 N-Channel FET
Pa	5-pin male header
Ra	1,500 ohm carbon 1/4 watt
Sa	5-pin female header

A set of both drilled and etched PC boards is available for \$5.25 plus \$1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

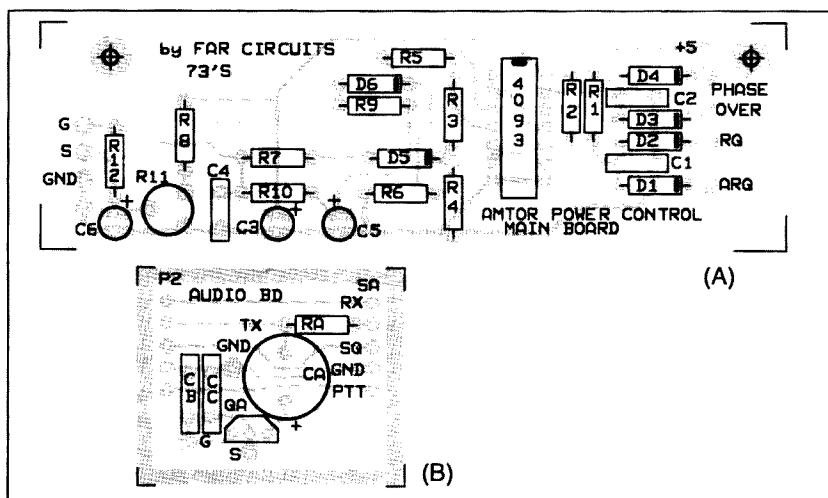


Figure 3. a) Main unit PC board parts placement diagram; b) Audio unit PC board parts placement diagram.

The Challenge of QRP

An introduction to low power operation.

by Michael Bryce WB8VGE

Ham radio has become pretty comfortable for most of us. Just about anyone can chase DX with a modern 100 watt microprocessor-controlled transceiver. *But just try that using minimum power!* That's the challenge of QRP. There's nothing like working a rare DX station with only 1 watt to sharpen your operating skills. But, of course, there's much more to QRP than DXing with low power.

What is QRP?

Well, it depends on what side of the fence you happen to be on. To me, QRP is RF output from a transmitter that is 5 watts or less, regardless of the input power to the transmitter. If you have 50 watts input and only 3 watts output, you're QRP to me. Your transmitter efficiency is really bad, but you're still QRP.

On the other hand, if you're working the CQ World Wide DX contest, and you're running a kW, by turning the amplifier off—thus dropping your power down to 100 watts—you're now QRP! In fact, let's take this one step further. Suppose the DX station you're listening to says, "QRP only please." Snap! Off goes the amplifier. You're now QRP and you make your con-

tact with 100 watts. That's far from operating with low power.

QRP is one of the internationally recognized Q-signals meaning: "Shall I reduce power?" Or: "Reduce power to _____ watts." Most hams have adopted it to identify low power equipment or operation. The QRP ARCI has formally adopted the power level of 5 watts as QRP. This is measured as output power from the transmitter. For really low, low power work, the term "milliwattling" has replaced the aged term "QRPP." The popular fire ball transmitter on 28 MHz proved it is possible to transmit coast-to-coast with 25 milliwatts! That's less power than the dial lights consume in most transceivers.

QRP is a great place to make new friends. QRP is a subculture within ham radio. Usually, when I tell someone I'm running QRP, the QSO changes from the usual, "Rig here is Kenwood and the weather here is warm" to a real chat with an interested human operator on the other end.

Building Your Own

Nothing in the world can beat the feeling of working a station using home-

brewed equipment—a QSO with gear you constructed with your own hands. The warm fuzzy feeling will last for days after the QSO is over. That's a feeling you don't get when operating the newest microprocessor-controlled SSB transceiver.

One of the most challenging and satisfying things a QRP operator can do is build his or her own gear. Best of all, you don't need to be a rocket scientist or an electronics engineer to build your own rig. In fact, QRP projects are especially suited for the neophyte in home-brew construction. Building a transmitter is relatively easy. Usually there's a wide tolerance range for parts, and most transmitters are built around straightforward circuits. Sometimes the transmitter is nothing more than a one-transistor oscillator coupled to an antenna. Only a handful of parts are required to produce 2 watts on most frequencies. You'll be astonished by the amount of DX you can work with just a spoonful of parts.

Because most QRP projects are simple, you usually won't have trouble finding parts for the rig. A well-stocked Radio Shack can supply you with all the parts required for a 75 meter CW transceiver. Companies like Mouser Electronics and

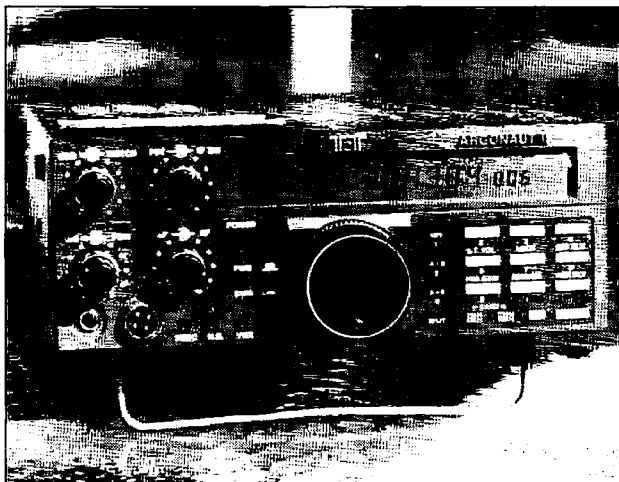


Photo A. The Ten-Tec Argonaut II is a full-featured QRP transceiver.

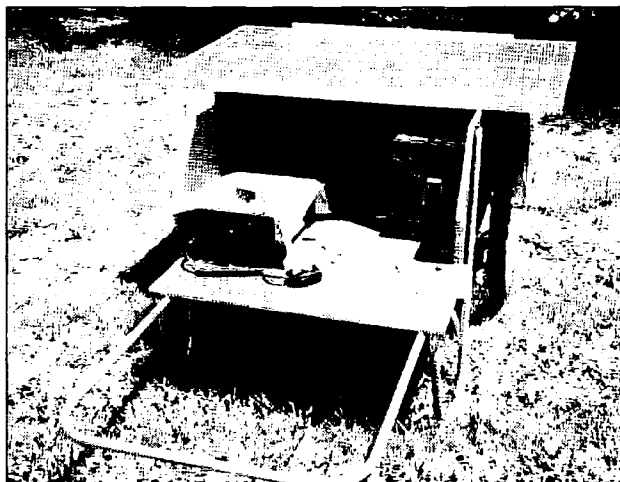


Photo B. Low power means portability. In this case, it's a solar-powered QRP wagon.

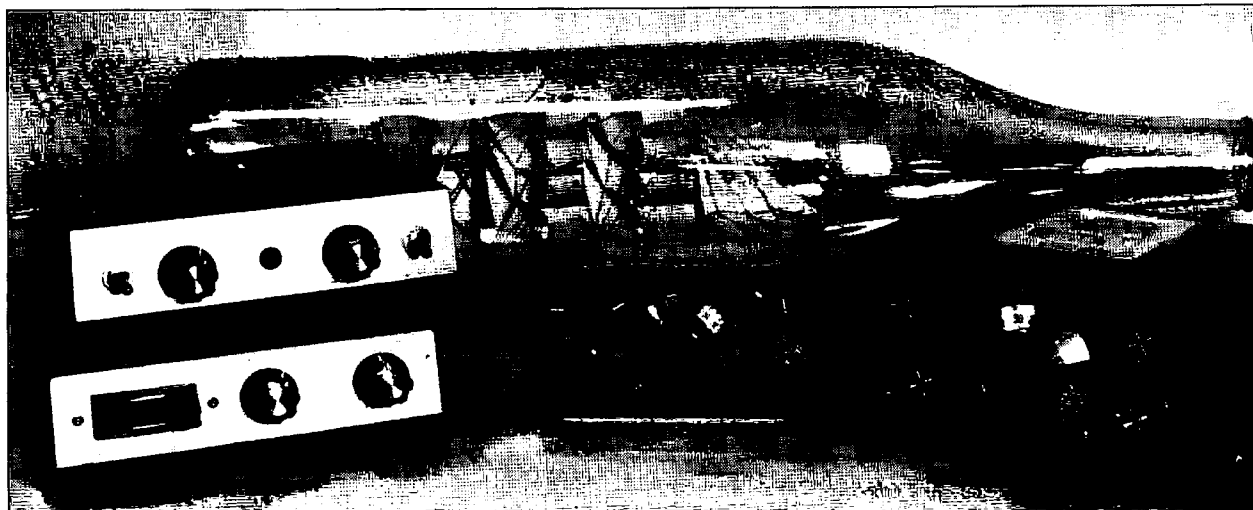


Photo C. Home-brew haven. Here is NR1A's QRP "ship in a bottle" setup.

Digi-Key will take small orders for one-secs and two-secs. Several hams have started their own companies supplying small parts just to the home-builder and the QRPer.

If you have a hard time getting the parts all lined up, several different companies furnish ready-to-go kits, too. Kits range from the very simple Roner by the G-QRP club, to the fully synthesized ARK-40 from S & S Engineering.

Sometimes the challenge of QRP comes from assembling a transmitter in the smallest possible chassis. I've seen rigs built in pill bottles, band-aid boxes, a match box, and even a Sucrets box.

Most QRP construction projects center around building QRP transmitters. There's nothing stopping you from rolling your own receiver either. The popular direct conversion receiver makes a perfect marriage for the QRP transmitter. A direct

conversion receiver is sensitive, and easy to build. Or you can go with several of the simpler superhet designs offered in 73. Many of these simpler designs rival the performance of much more complex receivers.

There's one more advantage to low power operation—TVI is almost unheard of with QRP.

Equipment for QRP Use

If you are a licensed ham, then you can operate QRP without spending one cent! All you have to do is reduce your output power and, snap! You're QRP. It really is as simple as that. You don't need to heat up the soldering iron if you choose not to, although you will be losing a gratifying part of the QRP environment.

All you need is already on your operating table—your HF transceiver. You don't need a special QRP rig to enjoy low power

operation, although there are commercial transceivers made especially for the low power enthusiasts. The popular Ten-Tec Argonaut II is a modern microprocessor-controlled QRP transceiver sporting all kinds of bells and whistles. The monobanders so popular today normally run QRP at 5 watts or so. Many commercial rigs, such as the ICOM IC-735, are easy to adapt to low power operation.

There's lots of used gear on the market, too. The popular Heathkit HW series of CW transceivers will still provide a lot of fun for very little cash layout. Used Ten-Tec Argonauts 505, 509 and the 515 provide 80-10 meter coverage plus SSB.

QRP and Other Frequencies

Alas, QRP is not only for HF use. Special QRP days have been set aside for the OSCAR satellites. Running too much RF on the uplink may damage

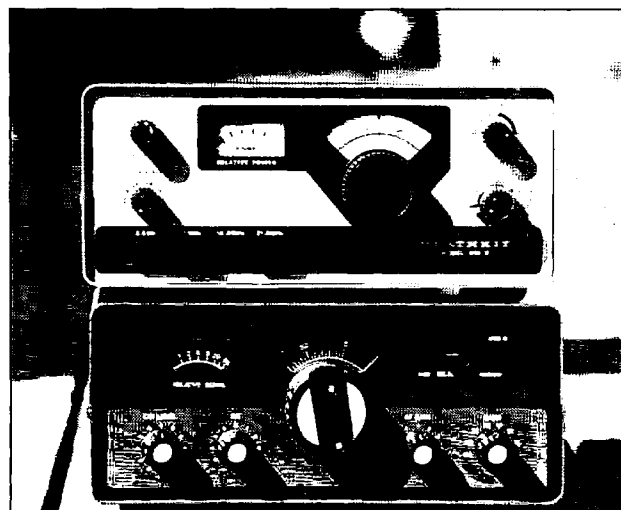


Photo D. The popular Heathkit HW-8 and HW-9 CW-only QRP transceivers. These are great fun!

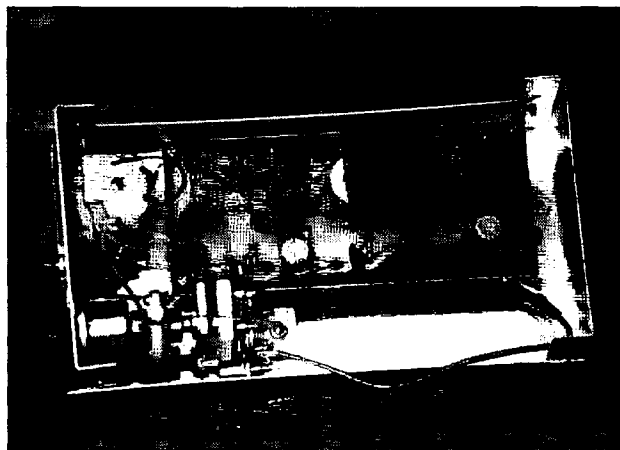


Photo E. A simple home-brew transmitter like this will provide worldwide communications without you laying out large amounts of cash.

or shorten the life of the bird's battery system.

Then there's meteor scatter and mountaintopping using low power. It's possible to work numerous states under favorable conditions using 100 mW of RF on 10 GHz. QRP is very much alive on frequencies above 30 MHz.

Lower Your Electric Bill, Too

Do you own an HT? Then you've more than likely gone QRP at one time or another.

How many times have you said, "I've switched to low power. How is my signal into the repeater now?" Perhaps it was unknown to you at the time, but you had just

discovered two important facts about QRP. First, you don't need full power all the time to have dependable communications. Second, running QRP will stretch your battery's life, greatly expanding your ability to communicate longer without plugging in.

Because QRP equipment is normally

QRP Q&A

Ever since my Novice days, I've been running QRP. I've collected files full of letters from hams all over the world asking about low power communication.

There seemed to be a pattern developing in the questions, so I picked out some of the more common ones. Here they are, in no particular order. Enjoy!

What is QRP?

QRP is a term adopted from the international RQS signals meaning to reduce power. Hams have taken this term and its meaning to be low power. Generally, QRP is 5 watts or less from the transmitter, regardless of the input power to the transmitter. If you hear someone on 40 meters calling CQ QRP, he (or she) is calling for a low power station. More than likely, they will be using low power, too.

What is QRPp?

QRPp is the older term for RF power of 1 watt or less. That extra small "p" meant really low, low power, generally under 1 watt. That term has been replaced by the term "milliwatt." While it may be hard to believe, you really can work around the world with an output power of 50 milliwatts! There have been many hams working DXCC with only 100 milliwatts to the antenna. It is hard to do, but not impossible.

What are the most popular QRP bands?

There really is no one band more popular than the others. You'll find QRP operation everywhere from DC to light. But, some consider the 40 meter band around 7.040 MHz to be QRP Central. You can also find some action on 7.035 MHz and 7.060 MHz. In the winter time, when summer QRN is down, 80 meters is very popular during long cold nights. There is QRP activity on 160 meters, too.

The 30 meter band is a QRPers' delight! Try 10.106 and up for low power signals. Then, let's not forget about the 20 meter band either. This is by far the most popular ham band when it comes to working DX. Low power operation used to be located around 14.060 MHz, but alas, other forms of digital signals have been moving down, overtaking the QRP-calling frequency. Check the entire band for QRP operators—they're everywhere on 20. You can find QRP signals on 17, 15, and 10 meters, too.

I'm not into CW. Can I still operate QRP?

CW is by far the most popular mode of QRP operation. It's partly because CW transmitters are easier to build than SSB rigs. With CW, you get more bang for the watt, too. But, QRP is not only CW, it's any mode you want to use, including FM or SSTV. Remember: QRP means low power—not CW only.

Do I need to change rigs or equipment to operate QRP?

Of course not! Most of today's rigs can be easily turned down from a front-panel control. You'll end up with low transmitter efficiency, but you won't have to spend a dime.

How about antennas? All I have is a simple dipole.

No matter what power level you use in amateur radio, the better the antenna, the better your signal will be. Use a good grade of feedline and get the antenna as high as possible.

I enjoy a good contest now and then. How can I compete with other stations if I run only 2 watts?

Most of the major contests, such as the CQ World Wide DX contest, Sweepstakes, and even Field Day, have special low power sections. You only compete against others within the same power class. You don't have to worry about the guy running a kW because you are not in the same class.

I know many QRPers like to build their own gear. I'm not much of a builder. Can I purchase a commercial QRP transceiver?

It's too bad you don't like to build your own gear. You're missing out on a lot of fun. But yes, you can purchase a commercial QRP transceiver. Ten-Tec

markets their Argonaut II QRP transceiver with all the good stuff we're used to seeing in today's gear. There are many other monoband rigs, such as the MFJ units, available. Tejas RF sells their popular Backpacker II fully assembled and tested.

Almost all of the circuits I've seen in the last few issues have been solid-state transmitters. How about us guys with boxes full of tubes?

It is the 1990s and today's technology is solid-state and microprocessors. But, if you want, you can still use a vacuum tube in a QRP transmitter. The best place to look for a circuit is in an old copy of the *ARRL Handbook*. Begin looking with the early '70s and work your way back to the '50s. Parts for those circuits may be next to impossible to locate, unless you have a really big junk box.

Can I operate packet or AMTOR?

Yup! Sure can. Again, QRP simply means low power. Any mode of communications is suitable for QRP, with the exception of moonbounce! I've had some great QSOs using AMTOR with less than 4 watts PEP.

Are there any QRP clubs to join?

Yes! As a matter of fact, I'm the publicity manager for the QRP ARCI, the largest QRP club in the world. If you would like to have one of the info kits, all you need to do is send \$2 to me (2225 Mayflower NW, Massillon OH 44646) and I'll have one in the mail to you the next day.

The Michigan QRP Club also serves low power enthusiasts with the *5-Watter*. Published four times a year, *5-Watter* makes for great reading.

There is also the G-QRP club. Based in England, they publish *SPRAT*, which is full of construction projects.

I like to collect awards. Can I still do so with QRP?

Yes! There are many, many awards issued just for QRP operation. These range from a WAS with QRP endorsement to the Miles Per Watt Award. Many other contests also provide a special QRP award such as the ARRL's Sweepstakes or the CQ World Wide DX contest.

What are some of the limits of QRP?

QRP is not push-button communications! There will be times when your 2 watts just won't cut it. Band conditions, QRM, sunspots, and QRN all take their toll on a 2 watt signal. There will be times when your 2 watts or RF won't be enough to make a contact.

Some modes don't seem to work as well as others. SSB, for example, is much harder to do with QRP power levels because everyone likes that *armchair copy*. You won't be armchair copy most of the time on SSB.

AM phone is really tough on QRP! It's possible to work coast-to-coast with AM phone on the 10 meter band using QRP, but on 75 meters and 40 meters it's not going to fly.

I'm on a limited budget. Would QRP be the best way to go to enter ham radio?

QRP means low power, not inferior equipment! Don't get the two mixed together. You could pick up an HW-7 at a hamfest for under \$50 and have a ball, or you could drop five grand for an ICOM-785, turn the drive down, and run QRP, too. While it is true you can pick up a brand-new rig such as the MFJ QRP monoband rig for about \$150, compared to about \$1,000 for an entry-level 100 watt rig, going QRP would save you money, but at a cost of only one band and being stuck with CW only.

If I start to operate QRP, what's in it for me?

No matter what you do in life, you get out what you put in. QRP really boosts your ego. Breaking a DX pile-up with 2 watts will keep a smile on your face for weeks. Working the West Coast with 1 watt from a transmitter you put together with your own hands is one of the best ways to generate those warm fuzzy feelings.

If you're tired of the quick, "Hi. Rig here is blank. Weather here is blank" type of QSO, give QRP operation a try. And if it's nothing else—it's *FUN!*

much smaller, power requirements are easily met with small batteries. A QRP transceiver is ideal for taking ham radio with you. You can easily carry a complete HF rig, including batteries, in a backpack. Hiking, camping or even white water rafting takes on a whole new meaning now that ham radio is aboard. There's also the possibility ham radio could save a life or two while you're out camping.

Battery power is all you need for worldwide communications from your home, too. In fact, most QRPers enjoy operating their gear from batteries. Solar power and QRP operation go hand-in-hand to supply all the energy requirements of even the busiest ham.

During a natural disaster, your QRP transceiver may be the only source of communications from the disaster area. During electrical outages, running your ham gear QRP style takes on a whole new meaning.

Getting Started

The best way to start in the fascinating world of QRP is to simply reduce your transmitter power a little bit at a time. This gets your feet wet without too much pain. You can make a contact at, say, 100 watts and then slowly reduce your drive until you're at only 50 watts. Drop the power down again, and then again. You'll really be surprised as to how low you can get before the signal becomes unreadable.

QRP is not push-button operating! If you're used to making a contact on one call, then an adjustment in thinking is in order. Anyone can work station after station, many times over, using less than perfect antenna systems with 100 watts. That's not so with QRP operating.

If you're used to getting 599 reports, you'd better be ready for lots of 349 and 239 reports. With 100 watts, you're always

59 on phone; with QRP, you'll be QRZ? QRZ? the station calling. Working WAS with QRP SSB is a real challenge! But, then again, many, many times, I've been 599 with 1 watt to the antenna. That's part of the thrill of QRP, you never know what will happen.

Efficiency is the Key to QRP

I know you've heard it before, about the guy who works DX with a set of old bed springs. Well, that's not going to cut it with QRP operation. You need the best antenna system you can muster up. Don't get me wrong, you don't need an antenna farm containing enough aluminum to build a B-52 to operate QRP successfully—but it wouldn't hurt, either!

"During a natural disaster, your QRP transceiver may be the only source of communications from the disaster area. During electrical outages, running your ham gear QRP style takes on a whole new meaning."

Antennas are placed as high in the air as possible. Only the best quality feedline is used between rig and antenna. Resonant antennas instead of trapped multiband antennas provide the QRPper with improved efficiency. Anything you can do to increase efficiency will improve your chances of making a solid QSO.

Operating Hints

There are many techniques for successful low power operation. Sometimes one particular technique will work this time, and then fail the very next day. Here are some of the many techniques I've found to be helpful in keeping the logbook filled with QSOs.

Get to know the bands and how they operate. Use propagation aids to find out what band will be open and for how long. Why, you might even want to find out how to figure out the propagation charts in the back of 73. There are disks full of computer programs to help you determine the MUF, or Maximum Usable Frequency. Using these programs will improve your QRP score. If the bands are dead, you might as well heat up the soldering iron and work on a project; QRP and crappy bands don't mix together well.

Tune the band looking for stations calling CQ. Answering the loudest station sending CQ helps, too. Another method is tail-ending a QSO. You tune around until you find a QSO in progress. After the two stations have signed, you call the loudest one. Most of the time you'll hear your call coming back. This is by far the most popular method of QRP operation.

If you only want to fill up your logbook, then work the state-side contests. The West Virginia QSO party will provide you with lots of quick QSOs. Why? Because you're an extra two points to the other station. You don't have to be in the contest to work contest stations.

Here's a strange one. Check out dead bands for activity. You never know: I've heard DX stations calling CQ on supposedly dead bands. It only takes a few minutes to tune around the high end of 10 meters for a quick check, even if the computer says the band is dead.

Anyone Can Operate QRP

A different frame of mind is all that is needed. It's the idea of doing more with less. QRP operation is surprisingly easy, fun, and a whale of a good time. It may be exactly what you need to put some snap back into ham radio.

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Operating QRP has always been a lot of fun for me. Operating QRP in the woods all by yourself, with a rig you built with your own hands, is a delight beyond words! You can join in the fun for yourself with the Backpacker II 40 meter transceiver from Tejas RF Technology.

The Backpacker II

The Backpacker II is based on the popular W7EL direct conversion receiver. The Backpacker II is an 1992 updated version using a doubly-balanced diode ring mixer. The Backpacker II has replaced the transistors used in the original version with low noise op amps. The results are outstanding! An improved method of frequency control is the heterodyne oscillator and mixer. In the Backpacker II, the VFO does not run at the same frequency as the transmitter. The VFO instead operates between 6.0 and 6.2 MHz in a Hartly oscillator configuration. This prevents RF from getting into the VFO and causing frequency shift or drift during key down. You get a 200 kHz segment of the 40 meter band with the VFO.

This method also allows the Backpacker II to operate on any single band (including 20,

17 and 15 meters) without losing stability due to VFO drift at the higher operating frequencies normally used in a direct conversion receiver. You could put the Backpacker II on any frequency by changing the output filters and tuned circuits. To make a band change, you'll need to change the crystal in the heterodyne oscillator and change the tuned circuit following the mixer. The tuned circuits in the amplifier stage will also need to be changed and the Backpacker II retuned. A band change kit is \$10 and includes the 11 parts required for a band change. In a way, the Backpacker II is really a monoband CW transceiver for 40, 30, 20, 17 and 15 meters. Of course, you can have only one band at a time.

A RIT circuit rounds out the VFO control scheme. The RIT control features a center-detent position allowing easy zeroing of the RIT. You cannot turn the RIT function off. The range of the RIT is ± 1.5 kHz. There is a spot control to find your signal in the receiver's passband.

The Receiver

The Backpacker II uses the Mini-Circuits Labs TUF-1 doubly-balanced diode ring mix-

er. Along with this mixer, additional filters reduce interference from the 40 meter broadcast stations. If you've ever operated a direct conversion receiver on 40 meters at night, you'll really relish the front end in the Backpacker II.

A low noise amp is used as an AF preamplifier. The other half of the op amp acts as an active low-pass filter designed to allow fatigue-free CW listening.

SSB Sounds Good, Too!

An LM380 audio amplifier gives the Backpacker II plenty of audio to drive a small speaker. If you're used to a direct conversion receiver with a wimpy LM386, you'll be in for a nice surprise at the amount of audio coming from this little rig. You can get a maximum of 2 watts of audio into an 8 ohm load with the LM380. A speaker is not included in the kit, but there is room-a-plenty to add one to the case if you wish. A front-mounted 1/8-inch jack for a headphone is included. In fact, all the controls for the Backpacker II are mounted on the front panel.

A second op amp provides an active CW bandpass filter. The two-position CW filter provides a 180-cycle bandwidth on CW-1 and a 110-cycle bandwidth on CW-2. Both filters are peaked at 750 cycles. You can set the bandwidth to the wide position, effectively removing the filter from the audio line. With the filters out, the bandwidth is approximately 2.2 kHz wide. A sidetone is injected to the audio channel and its injection level may be set to your own liking. The sidetone volume tracks along with the audio control.

The Backpacker II uses differential keying. This is a fancy way of saying the rig shapes the CW signal and switches over to transmit before the RF reaches the antenna. The time sequence differential, keying properly and timely, performs several T/R functions. The Backpacker II keys very nicely. It has electronic QSK keying, making for silent QSK keying with no relay chatter breaking the quiet of the woods. The receiver draws 25 mA with no signal to about 100 mA with reasonable volume. The entire Backpacker II weighs in at a mere 23 ounces.

The Transmitter

The transmitter is made up of one driver stage and the PA. The VFO signal is applied directly to the driver via a trimmer. This pot can be used to set the output power of the

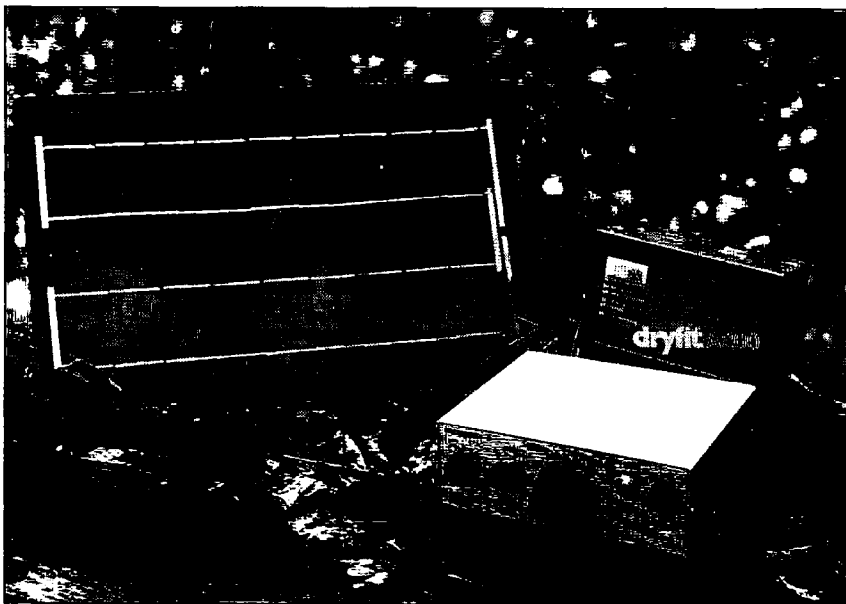


Photo A. The Backpacker II is at home in the woods. The 40 meter version is pictured here with a 10 watt solar panel and a 6.5 amp/hour gel battery providing the juice.

Backpacker II. A 2SC799 provides the bang for the transmitter. The Backpacker II will produce about 2 watts output on 40 meters, more than enough to provide worldwide communications. The PA is protected against high SWR by a 36 volt zener diode. The transmitter output is fed into a half-wave low-pass filter to suppress any harmonics. The transmitter requires 12-14 volts at 300 mA.

The transmitter uses an RCA phono jack for the antenna. Thinking Bill was just being cheap. I wondered why he did not use an SO-239—until I read through the manual. The silk-screen for the antenna jack is applied low enough to allow the builder to add an antenna jack of his choice. You can use a SO-239 or a BNC connector if you wish. Of course, you can always just use the RCA jack supplied for the antenna.

Putting It Together

My Backpacker II came already assembled and tested so I did not have the pleasure of building it myself. For those looking for a diversion for the weekend, the Backpacker II is going to make you feel right at home with the soldering iron. However, the Backpacker II is not for someone building their first kit. A good basic knowledge of soldering and knowing what a diode looks like and how this guy goes on the PC board is a must. All coils come fully wound and ready to be installed.

The case needs mentioning, too. It's solid 5052 aluminum with epoxy silk-screened letters. They're tough enough to be washed with Formula 409 and still remain on the aluminum. Thankfully, there are no holes in the cabinet for dirt, twigs or critters to move in.

There are many wires connecting the three PC boards together. It would be very easy to get messed up and put the wrong wire

in the wrong hole. A highlighter pen would be very useful in keeping track of what wire goes where.

The manual contains all you could ask for in getting your Backpacker II on the air. There's even a section on antennas. There is a complete parts list and a set of oversized PC parts placement diagrams. Full adjustment and set-up procedures are included. If you can't get it to work, there is also a trouble-shooting guide to help you track down the trouble. The Backpacker II comes with a 90-day parts warranty.

Out in the Woods

Running the Backpacker II in the woods proved to be a lot of fun! I used a random wire for an antenna and a small Ten-Tec antenna matcher. A small 10 watt solar panel and a 6.5 amp/hour gel battery provided the power.

Using a high performance direct conversion receiver is hard to describe. Signals seem to POP out of a noiseless background. There are no birdies to contend with and no phase noise from a PLL to get in the way.



Photo B. Under the hood of the Backpacker II you can see the transceiver's three vital PC boards.

The time sequence differential keying proved very nice and the QSK worked quite well. With a nominal 1.5 watts out, there is enough bang to make things interesting without fretting about the batteries going flat.

I made contacts all up and down the East Coast using the Backpacker II. It's a solid 40 meter transceiver that I know you'll have a good time with. It's even more of a delight when you're working the world from your own stump in the woods.

73

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The RASER Revisited

How this superior HF dipole antenna can be improved.

by James E. Taylor W2OZH

The original article on the RASER ("The RASER: A Novel Wire Antenna System," by James E. Taylor W2OZH, 73 *Amateur Radio Today*, September 1992) showed how a dipole can be extended to provide enhanced gain with a length much less than the normal two half waves in phase. This was accomplished without the need for either a high-impedance feedline or an external antenna tuner. Both end-fed and center-fed options were described. This article will show how I increased the gain of the RASER appreciably while using an improved coupler circuit, which also provides decreased feedline radiation.

The RASER Concept

The center-fed RASER for 75 meters is comprised of a dipole lengthened by self-resonant Divided Coherent Radiator (DCR) sections on either side of the center feed point. Since the RF currents in the adjacent DCR sections are essentially equal and in-phase, the antenna shown gives a power gain of roughly a factor of two over the normal figure-eight pattern of a classical dipole. Such a 20-section RASER is shown in Figure 1. Each DCR section is comprised of a chosen length of wire, which acts as an inductor, and a capacitor which, together with the inductor, forms a series resonant circuit. The wire length was chosen to be 57 inches and the corresponding capacitance was 750 picofarads. Figure 2 shows the scheme for mounting the capacitors, which were potted in insulating foam. I adjusted the antenna to resonance by changing the lengths of the two terminator wires and by selecting the capacitance in the coupler unit, shown schematically in Figure 3. The coupler unit used a bifilar-wound powdered-iron toroidal transformer for impedance matching. This 20-section RASER was used at W2OZH for over a year with outstanding results.

How Can the RASER be Improved?

Critical review of the above design gives rise to three constructive questions:

1. Could the common-mode shield radiation be decreased by placing the shield connection at the tap on the transformer, to bring it closer to the electrical center of the

balanced radiator?

2. Could the capacitor in the coupler unit be eliminated by direct connection to the feedline?

3. Could the inductive component then remaining at the feed point be counteracted by increasing the capacitive reactance of the terminators, i.e. by shortening them? If so, can the number of DCR sections then be increased to improve the gain, without a net increase in the overall length of the antenna?

I investigated each of these possibilities, and made the following improvements in the design.

The Balanced Coupler Circuit

The previous coupler circuit, shown in Figure 3, which involves a simple autotrans-

former connection, can be redrawn as in Figure 4 to clarify ground relationships. Referring to Figure 4, the two halves of the RASER radiator naturally comprise a balanced symmetrical circuit with a virtual ground at the center. It is apparent that the shield connection is not isolated from RF ground and should ideally be placed at this center rather than at the right-hand side as shown. The unbalanced feed system shown does not discriminate against common mode coupling with its attendant feedline radiation. The circuit arrangement shown in Figure 5 would improve this situation by placing the shield connection electrically much closer to the natural virtual ground of the radiator.

I experimented with this change (Figure 5) and found that the RF current on the

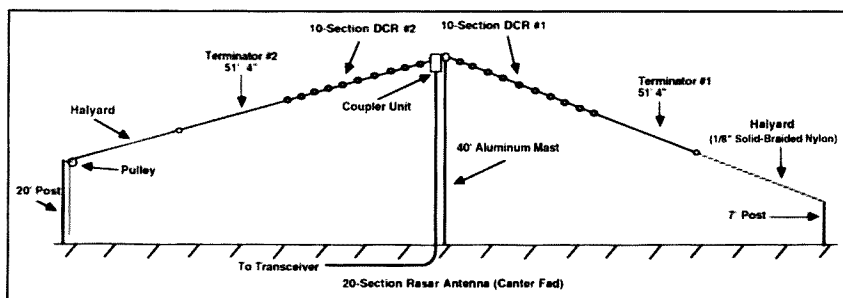


Figure 1. 20-section RASER antenna (center-fed).

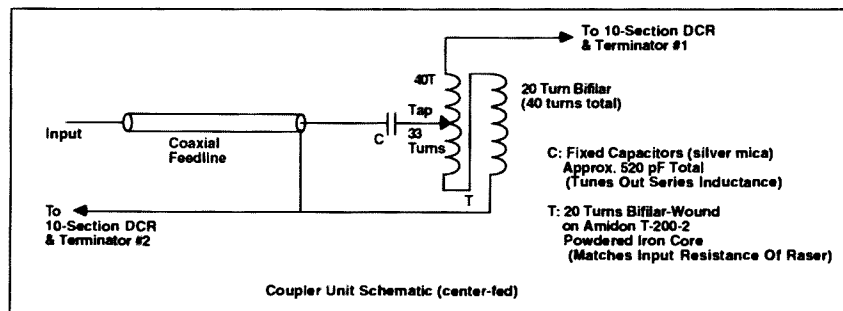


Figure 3. Coupler unit schematic (center-fed).

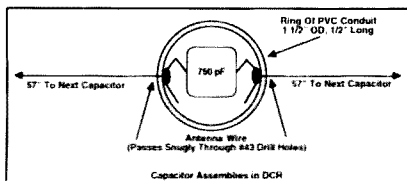


Figure 2. Capacitor assemblies in the DCR.

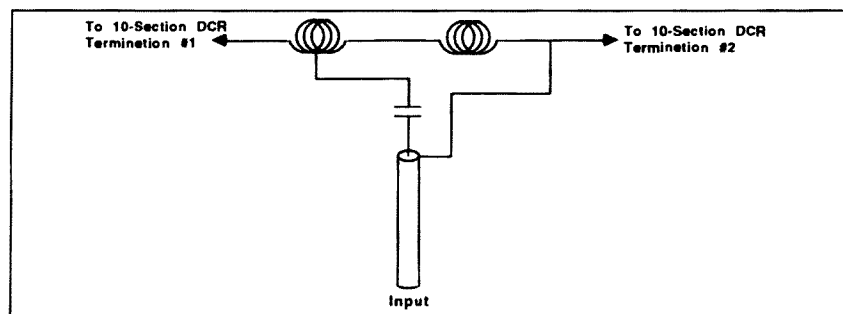


Figure 4. Original coupler unit (redrawn).

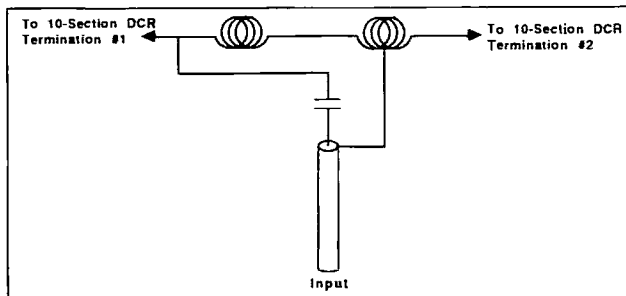


Figure 5. Original coupler unit—balanced input.

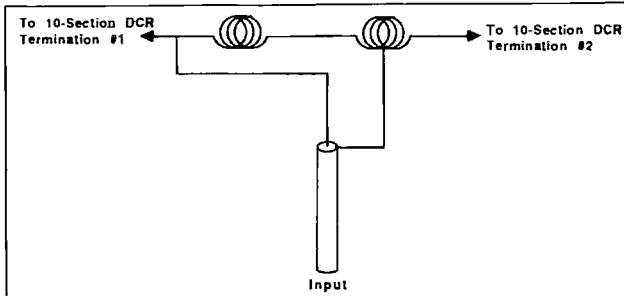


Figure 6. Improved balanced coupler unit (no capacitor).

shield of the coax, as measured by an MFJ H-field Antenna Probe, was decreased substantially. Resonance measurements using a noise bridge led to changes in the value of capacitance required for resonance. This is consistent with the measured reduction of common mode coupling, further confirming that the answer to question 1 above is "yes." During these experiments I noticed a prominent resonance point some 100 kHz below the desired frequency of 3.953 kHz. This led to experiments answering questions 2 and 3 above.

Elimination of the Coupling Capacitor

As an experiment, I replaced the coupling capacitor by a direct connection, as shown in Figure 6. This leaves a substantial uncompensated inductive reactance at the feed point, which lowers the resonant frequency

of the system. The measured resonant frequency of the 20-section RASER with the terminator lengths of 51' 4" was lowered to below 3.7 MHz. Thus, the answer is "yes"—the capacitor can be eliminated.

Re-Resonating the Radiator

I then made the terminators incrementally shorter, which raised the measured resonant frequency of the radiator. Since the terminators had been made shorter I was able to add more DCR sections for greater gain without any increase of the overall space required. These experiments showed the desired deep resonance nulls on the noise bridge with very satisfactory bandwidth. Thus, the answer to question 3 above is also "yes"—the capacitor can be eliminated and the number of DCR sections can be increased.

Thus, the procedure which I followed was first to add DCR sections and then to adjust resonant frequency by changing the length of the terminators. I found that increasing the number of DCR sections to 12 on either side of center and changing the terminator length to 29 feet gave a deep resonance null (signifying a pure resistance) on the noise bridge at a frequency slightly above 4.0 MHz. This indicated that, for my available space of some 200', I could increase the number to 30 DCR sections (15' either side of center). The final RASER design is shown in Figure 7.

The Final Design Values for Two RASER Radiators

At W2OZH, a two-element phased array is used so it was necessary to optimize the

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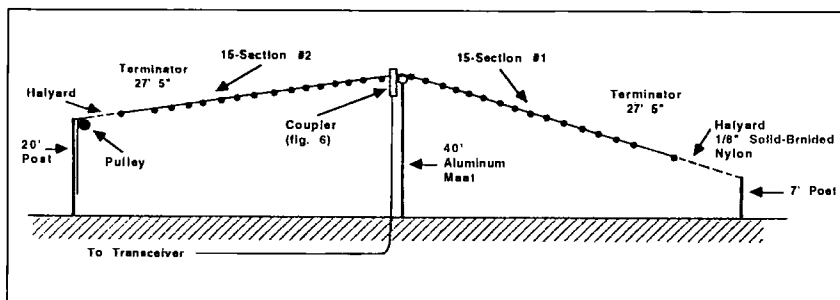


Figure 7. Balanced 30-section RASER—(center-fed).

lengths of two parallel RASERS. This simply involves adjusting the lengths of the two identical terminator wires until the desired frequency, in my case 3.9535 MHz, is approached. The final design values are shown in Table 1.

The differences between the two RASERS are probably due to the proximity of nearby buildings, trees, etc. However, these measurements indicate a level of variation to be expected in other installations of this outstandingly effective antenna.

Results

The experiments described produced the serendipitous results of a simplified design which yields improved performance. The use of a coupler connection which is balanced to ground measurably decreases the

feedline radiation due to common mode coupling. The elimination of the coupling capacitor simplifies resonance adjustment and the attendant shortening of the terminator wires permits the insertion of 50 percent more DCR units to further increase the gain of the radiator.

The modifications of the RASER described above were confined to the center-fed version because this configuration is suitable for my site. However, similar changes can be made in the end-fed arrangement. The procedure would only involve reversal of the input connections to the transformer in the coupler, elimination of the capacitor by direct connection, and experimental adjustment of the single terminator wire. All other adjustments should remain as described in the original article. Although the

Table 1.

Terminator Lengths	Tap Position	Resonant Frequency
27' 5" (east radiator)	25 turns	3.954 MHz
26' 2" (west radiator)	26 turns	3.948 MHz

parameters indicated above are for the 75 meter band, the design can be modified for any other band. This would involve using the steps of design described in the original RASER article, but scaled for the chosen frequency of operation. It would be interesting to see the performance of a RASER designed for, say, 20 meters, where a high gain, linear beam antenna could be realized for point-to-point DX communication.

I have now used the 30-section RASER design in a two-element phased array for several months with even better results than for the previous 20-section version. It is my perception that the directivity has been improved and the large capture area of the system for reception brings about a dramatic decrease in fading of the signals. Results experienced when I have occasionally worked QRP stations lead me to believe that this would be an outstanding antenna for that application.

I wish to acknowledge the patience of many hams who have given signal strength comparisons as I switched several available combinations of RASER elements. 73

UPDATES

Number 9 on your Feedback card

Nine to 10

Refer to the above article on page 56 in the July 1993 issue. KD4GRZ has pointed out a typo in the Parts List for the converter. The correct values

are as follows: C4 - 0.01 μ F, C7 - 0.01 μ F, C8 - 100 pF, C9 - 0.01 μ F, C10 - 10 μ F electrolytic.

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by Steve Katz WB2WIK/6

The MFJ-451 Morse Keyboard

A perfect fist, right out of the box.

As an avid CW operator who uses this albeit archaic mode more than any other, I was overjoyed to see MFJ introduce their new MFJ-451 Morse Keyboard; finally, an affordable, state-of-the-art product that will fit into nearly anyone's station and budget! Even better, this item is almost totally self-contained and requires no connection to a computer to make it work, allowing die-hard CW ops like me to take it portable. (I say "almost" self-contained because it does require a source of 12 VDC power and cannot be operated from an enclosed battery—too bad. Its current consumption of about 250 mA DC—3 watts!—would not allow a little 9 volt Duracell or Energizer to last very long, anyway.)

I don't know about you, but I'm really turned off by new products that take hours of

set-up time and pouring through instructions to operate. This is probably why I only use computer software that is so intuitive it requires no more than loading in a disk to get going. The MFJ-451 is perfect for those of us who like to just "plug and play." Although it is supplied with a well-written, nine-page instruction manual, reading the instructions is *not* prerequisite to using the keyboard as soon as you take it out of the box. I had mine on the air within about two minutes after the UPS shipment arrived!

The MFJ Morse Keyboard is actually two items: The keyer, which is enclosed in a tiny 1-1/4" x 3-1/4" x 4-1/4" (HWD) black metal case that also contains the power ON-OFF switch, sidetone monitor volume adjust control and monitor speaker; and the keyboard,

which is a standard PC-AT keyboard with a normal five-pin DIN connector (just like any PC keyboard). The keyboard supplied by MFJ is made by Mitsumi Electric Co. in Malaysia and is of very high quality with an excellent "feel," but *any* AT keyboard will work as well. The manufacturer warns that use of an XT keyboard, or using an AT keyboard switched to the "X" mode, will *not* work and may even damage the keyer, so if you don't already have an AT-type keyboard, I'd surely recommend using theirs. Although there are other differences, an AT keyboard is most easily recognized by its row of 12 function keys (F1-F12) across the top, above the standard typewriter keys. (XT keyboards ordinarily have just 10 function keys F1-F10, located on the left-hand side of the keyboard,



Photo A. The MFJ-451 Morse Keyboard Keyer is primarily a keyboard, as you can see. The keyer electronics is all inside the tiny black box. The front panel contains only a volume control, status indicator LED, and sidetone volume control.

arranged in two vertical columns.)

The keyboard supplied by MFJ with the Model 451 keyer has abbreviated operating instructions describing the 12 function key operations printed on a label placed in the upper-right corner of the keyboard. A key overlay or a long label placed above the 12 function keys might be nicer, but this thing is easy to get used to, and once you've used it for an hour or so, there's no longer any need to refer to the label, anyway.

The keyer unit itself is so small and lightweight that it could probably be "velcro" attached to most rigs in an out-of-the-way location. You really don't need to access its two controls (ON-OFF and sidetone monitor volume level) at all if your transmitter or transceiver has its own sidetone and you switch power to the keyer along with your radio. Although MFJ doesn't mention this in their instructions, you could also run the keyer off a regulated source of 5 volts DC with a minor rewiring job internally: Just rewire the "output" terminal of the 7805 regulator chip U5 to the "DC input" jack on the rear panel of the keyer, and it will run on 5V; however, if you do this, be sure to *never* connect that jack to a higher-voltage source, or you'll risk destroying the 80C32 keyer chip U1!

The keyer has just five rear-panel connections: Keyboard In (five-pin DIN), Power In (12 VDC, using a standard 2.1 mm coaxial plug with center positive); Paddle In, which allows use of a conventional three-terminal electronic keyer paddle, should you decide at some times to not use the keyboard (3.5 mm stereo "mini" phone plug); External Speaker Out, to override the internal monitor speaker (standard 3.5 mm monaural "mini" phone plug); and Keyer Out, which is the keyed line to your transmitter (RCA phono plug). The keyer output can be arranged to key both positive and negative-polarity transmitters and comes factory-wired to support positive-keyed solid-state transmitters. MFJ calls this "direct" keying (as opposed to "grid-block" negative keying, used in many older, tube-type rigs) and uses a VN10KM power FET as the internal keying switch—a good choice of device for the application.

Like all keyboard keyers I've seen, the keyer uses a buffer between the keyboard and the keyed output line, so you can "type ahead" of your actual sending speed, up to a maximum of 200 characters. Adjusting the keyer sending speed to be precisely the same as your typing speed will result in "real time" sending, which is very tricky at best and leads to jerky-sounding sending. It is much better to set the sending speed to be somewhat slower than your actual typing speed, and use the "type ahead" buffer to take up the slack. Since I type at 75-80 wpm (375-400 characters/minute), and nobody can really copy code that fast, I found it convenient to set the sending speed (accomplished by depressing F3 and then typing a two-digit speed from "05" to "99" wpm) at a normal conversational rate of maybe 20-30 wpm. Then I happily type away at my more comfortable, faster speed. For a real typist, this takes no getting

used to at all, but for a "hunt and peck" typist, this might take a bit of self-training.

To let you know that you're running out of buffer memory, the keyer sidetone frequency lowers in pitch when the buffer is filled to 180 characters. When the 200-character buffer is completely filled, the sidetone will sound an error message with all additional keystrokes. Pressing the "escape" key (ESC) on the keyboard while it is sending your type-ahead message will immediately stop the keying and clear the buffer. Pressing the "pause" key (upper right-hand corner of the AT keyboard, next to "scroll lock") will stop the message, allow you to insert additional text using a paddle key, and *not* clear the remaining buffer memory; then, pressing the "escape" (ESC) key will continue playing the buffer memory where it left off before pressing "pause."

In addition to the sending speed being adjustable by keyboard command as described earlier, additional adjustments may be made for sidetone frequency (F2); keyer weighting (F4); two 100-character messages which may be preprogrammed (F5 and F7); playing the contents of those two memories (F6 and F8); putting your transmitter into the "tune" mode

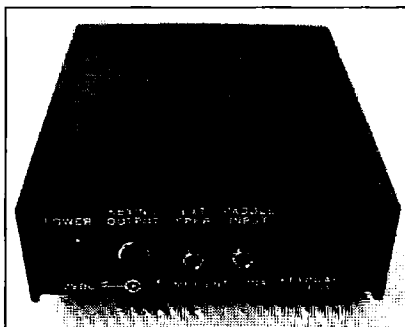


Photo B. The rear panel of the MFJ-451 keyer box contains I/O ports for: 12 VDC in; keying output; external speaker; paddle input; and keyboard input.

by sending continuously (similar to closing a hand key) by using another function key (F1); and even converting the keyboard space bar to a hand key (F12). When you're entering text into one of the memories, your keying sounds on the local sidetone monitor but the keyer does *not* key your transmitter. Another way to practice using the keyboard while it is connected to your transmitter, when you want to hear what you're keying in on the sidetone speaker but don't want the keyer to actually send a signal over the air, is accomplished by using the Key Output Disable function (F9). Two other function keys, F10 and F11, are used for serializing messages, such as would be required in the ARRL Sweepstakes and some other contests.

The MFJ Morse Keyboard is set up to send not only regular alphanumeric characters (A-Z and 0-9), but many amateur radio prosigns as well. These include popular prosigns like BT (double dash, used between thoughts instead of a period); HH (eight dits, thought to indicate "error"); AS (standby); AR (end of transmission); SK (end of contact); as well as

many not-so-popular ones like AL (new paragraph); SX (dollar sign, \$); KN (response expected from one station only, directed) and so forth. To use the prosigns effectively, one must pretty much memorize which single key sends them. For example, BT is sent by using the = (equals sign) key; the error message (eight dits) is sent by using the @ key; AS is sent by using the & (ampersand) key, etc. Some of these prosign assignments aren't particularly logical and it takes some getting used to, but the limitation is the AT keyboard, of course. Again, a keyboard overlay provided by MFJ might help users remember these key assignments. Regular punctuation signs like . (period); , (comma); / (slash bar, used to indicate portable operation); and ? (question mark) use the regular keys that are so labeled.

The MFJ-451 also includes three "embedded command" functions which are addressed with two keystrokes rather than a single one. For the embedded commands, CTRL (the Control key, located at the lower left and right of the AT keyboard, below the SHIFT keys) is used along with the keys for L, P or S, depending on which embedded command feature you are using. CTRL-L creates a repeated message, like a beacon identification or a CQ, which, after addressed, will play repeatedly until stopped by pressing ESC (escape). CTRL-P allows the insertion of a timed pause within a message. CTRL-S allows the insertion of a sequential serial number within a message, and, to avoid wasting time, sends the letter "N" for nine and a "T" for zero, just like experienced CW operators do. These functions are all quite handy.

The message memories addressed by F5 and F7 (and played back by F6 and F8) are limited to 100 characters each, which is more than sufficient for anything I could think of. So that you needn't count characters when programming these memories, the sidetone pitch lowers in frequency when you type past 90 characters, letting you know you only have 10 characters left in memory.

The Morse Keyboard operates as naturally as a typewriter and does not require a lot of thinking during operation. If you make a typing mistake, simply press the BACKSPACE key and the keyer will erase the last character typed and allow you to make a correction. The space bar inserts a word break space in the text, just like you are used to doing with a typewriter or word processor. The SHIFT key enables upper case characters if applicable. (In alpha text, the SHIFT does nothing; but punctuation and prosigns can be addressed and changed with the SHIFT key.)

How does it work on the air? Like a dream. As I said, this product takes literally zero familiarization period for an experienced typist, and operates intuitively enough for immediate use right out of the box. I didn't get around to reading the instruction manual—which is imprinted with the bold warning "Always Read All Instructions Before Operating New Equipment" on its cover—until after my first couple of dozen QSOs. This is the perfect device for those who, like me, enjoy instant gratification

with a new "toy." Because I hadn't used any kind of keyboard keyer in years, I was just a bit shaky during my first few contacts and sent apologies in advance for any mistakes I might make: "Bear with me, OM, I'm using a brand-new keyboard keyer, so pardon my sending." No excuses were necessary, though, as I had it all under control right from the start. Everyone complimented my wonderful "fist," although I wasn't doing anything, just happily typing my thoughts on a keyboard as I've done since I was a kid in grade school.

Dream On Department

When a product is this easy to use and so reasonably priced, I feel badly about asking for anything more. But nothing is perfect, and we hams are impossible to please, so here goes. The MFJ-451 does not make use of the numeric keypad on the right-hand side of the AT keyboard, so numbers must be sent using the numeral keys on the main QWERTY keyboard (top row). For those of us who are really used to using calculators, this is a tiny handicap: I'd rather use the numeric keypad and wish it were enabled by the MFJ firmware. Next, rather than two 100-character memories, I'd rather see four or five smaller memories. I never have anything so brilliant to send that it would require 100 characters, but I might want to use a bunch of smaller

memories in a contest. Example: For contesting with a normal memory keyer (and paddle), I often load one memory with "WB2WIK;" another one with "QRZ? DE WB2WIK;" another with a full-length (3 x 3) "CQ;" another with a short (1 x 1 or 2 x 2) "CQ;" another with a brief contest exchange like "TU 599 03 DE WB32WIK BK;" another with a slightly different contest exchange like

"The MFJ-451 is the cat's meow (am I aging myself?) and definitely the thing for avid CW ops, or even casual operators who enjoy CW but are tired of banging away on a key."

"CFM TU UR 599 03 DE WB2WIK BK;" another with "CFM (or QSL) TU 73 DE WB2WIK QRZ?" and so forth. I'm used to this format, as most CW contesters are. Lastly, I wish the MFJ-451 didn't consume so much DC current and could be operated from a 9V battery so it would be a true stand-alone unit for portable work. (It does work on 12V, so most portable operations can support it, but this means another DC power cable, another set of connec-

tions, etc.) Note: For home station operation, MFJ does sell a "cube" type power supply, the MFJ-1312B Power Adapter. Many hams will already own such an accessory.

Wrapping Up

The MFJ-451 is the cat's meow (am I aging myself?) and definitely the thing for avid CW ops, or even casual operators who enjoy CW but are tired of banging away on a key. If you're a reasonably good typist, it will give you a perfect "fist" which can be tailored to suit your liking. For the price, I can't believe every ham who ever operated CW won't want one. The MFJ-451 is available from authorized MFJ dealers (which are everywhere) and its suggested retail price is only \$89.95. MFJ's address is P.O. Box 494, Mississippi State, MS 39762. They have two unique customer service programs: (1) If you are interested in any MFJ product, they will send you the owner's manual on request, free of charge; (2) If you buy a product and need technical assistance with it, they have a toll-free help line, which is (800) 647-8324. MFJ has come a long, long way from their start as a little company producing inexpensive ham accessories and I must commend them for growing rapidly and greatly expanding their product line, manufacturing all products in the U.S., and still remaining competitive in this very aggressive marketplace.

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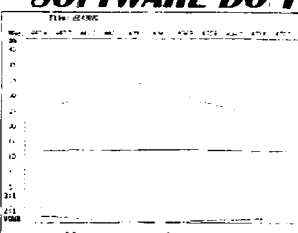
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A New Look at a Simple VFO/Exciter

Stable tuning with minimal parts.

by Ken Cornell W2IMB

Some 20 years ago many experimenters became interested in the low frequency experimenter's band. To work this band, which ranges from 160 to 190 kHz, many so-called "LOWFERS" used self-excited oscillators to avoid the high cost of low frequency crystals.

As receiving techniques improved, including the use of extremely sharp filters, a stable transmitting frequency became necessary for serious communications.

When the CMOS 4000 series of Binary Ripple Counters (frequency dividers) became available, they permitted us to use high frequency crystals for control and provided divider outputs into the 160 to 190 kHz band. The 4024 and the 4040 were popular ICs using crystals in the 5120 to 6080 kHz range; using the "divide by 32" output would put you into the band. The frequency limitations on these CMOS 4000 series was 6 to 7 MHz.

Some years ago, the high speed 74HC series and 74HCT4000 series became available and these had an operational range up to 50 MHz. The pinout of the 74HC4024 and the 74HC or 74HCT4040 are identical to their CMOS 4020 and 4040 counterparts, with the exception that their operational voltage is 6

volts for 160 to 190 kHz. In this case, any drift in the oscillator would be lessened by 128 times. The end result was an extremely stable signal.

Next came the thought: Why not use this same principle to build a 160, 80 and 40 meter VFO/exciter? By using VFO tuning from 27.2 to 32 MHz, and by using "divide by 16" for 160, divide by 8 for 80 and divide by 4 for 40 meters, a stable VFO emerged.

Construction

I breadboarded several circuits and ended up with the version shown in Figure 1.

I intentionally used easily available disc ceramic capacitors to see how stable the VFO would be. Normally, silver micas and NPOs would be called for in a VFO. However, I was quite pleased with the stability after a short warm-up.

Since the oscillator is operating at a higher

"Due to the light coupling and apparent stable load on the oscillator with the key in either the up or down position, keying is very clean."

volts maximum, making them ideal for operating with a 5 volt regulator such as the 7805.

I got the idea of using a 74HCT4040 with a VFO operating in the 20.48 to 24.32 MHz range and using the "divide by 128" output

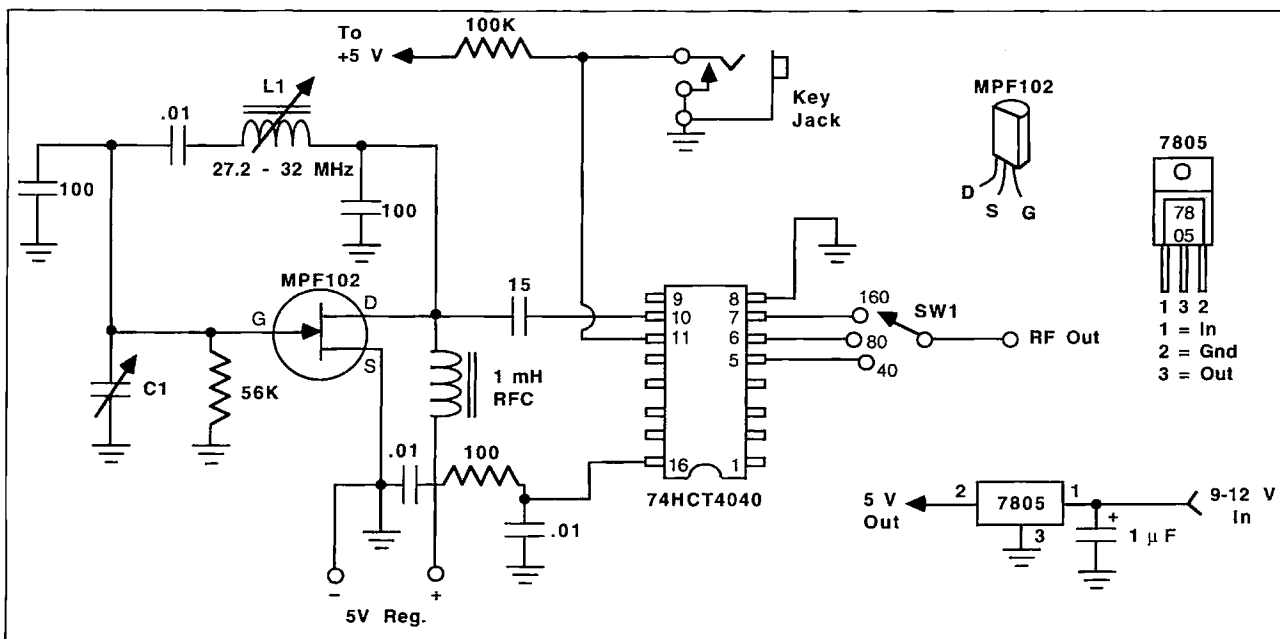


Figure 1. The simple VFO/exciter and voltage regulator circuits.

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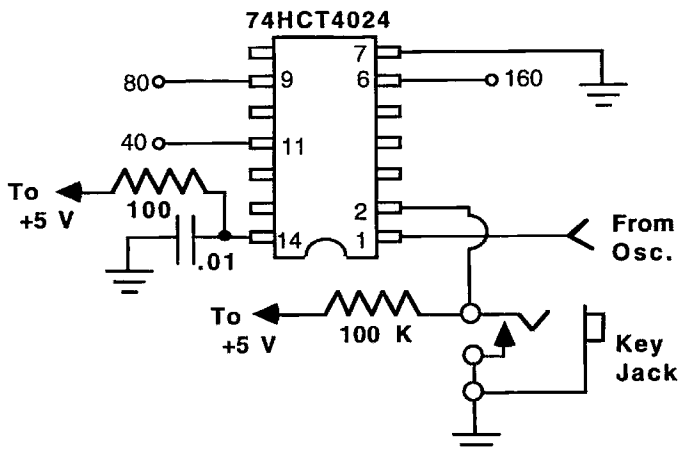


Figure 2. Pinout for substituting with the 74HC4024. Note: When the key is used and up, plus bias is applied to Pin 2 which disables the device. When the key is down, Pin 2 is grounded and the chip becomes active. This also applies to the 74HCT4040 at Pin 11.

frequency than the used frequency, it can be left running and that helps the stability.

Due to the light coupling and apparent stable load on the oscillator with the key in either the up or down position, keying is very clean.

The only difficult part is getting the proper tuning range using the slug and tuning capacitor C1. If you don't have access to a frequency counter, I suggest that you take the "divide by 16" output from pin 7 and tune your receiver to the 1500 to 2000 kHz range. Use a good variable capacitor of 50 to 75 pF for C1. Tune the receiver to 1850 kHz and with the tuning capacitor at mid-range, and

adjust the slug in L1 to zero beat. The tuning capacitor should now be able to tune 1700 to 2000 kHz. If the capacitor is too large, you can add a trimmer capacitor in series with same and adjust the tuning to suit.

I suggest that, when you're satisfied with the tuning range, a vernier drive be used for C1. Actually, a fixed capacitor for C1 could be used and the tuning accomplished by using the slug adjustment.

For those who wish to substitute a 74HC4024, the pinout is shown in Figure 2.

As with any VFO, sound construction should be used and the circuit should be enclosed in a shielded cabinet.

Parts Description

C1	See text.
L1	9 turns #22 solid insulated hook-up wire wound on a 5/16" diameter slug tuned form for a 3/4" winding length.
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The ARK 40 QRP Transceiver

Enjoy synthesized tuning in a low-cost monoband rig.

I've said it before many times: "What the world needs is a low-cost synthesized QRP transceiver." Of course, all my friends tell me that's a pipe dream and I'll never see it. Well, it's the '90s—and the folks at S & S Engineering have made my dream come true.

The ARK 40

The ARK 40 is a fully synthesized QRP transceiver running 5 watts on the 40 meter band, a *favorite* QRP band. Band coverage is 7.000 to 7.1999 MHz. Several other bands are also in the works, including 20 and 30 meters. The ARK 40 is a CW *only* transceiver. Full break-in (QSK) keying is used in the ARK 40.

The ARK 40 utilizes a superhet receiver with a bandpass of 600 Hz. The receiver tunes in 100 Hz steps via a push-button thumbwheel. The four digits of the push-button tuning switch represent 100 kHz, 10 kHz, 1 kHz, and 100 Hz respectively.

Sensitivity is rated at 0.3 μ V {10 dB (S + N)/N} with a blocking dynamic range greater than 75 dB. The third order intercept point is a rather impressive $>+10$ dB. The ARK 40 comes to you as a kit, for under \$270. An optional keyer is \$40 and fits inside the ARK 40. The keyer is based on the Curtis 8044 chip. There is enough room inside to install your own keyer board, too.

The ARK 40 comes with a guarantee to work as specified or the manufacturer will fix it for you. If there is a problem caused by a fault of their own, it will cost you only one-way postage to the factory. If it's your fault, they'll fix it for under \$25. The manual gives all the details of the guarantee.

A Look Inside

What makes the ARK 40 stand out among the rest of the QRP monobanders is the synthesized frequency control for both the receiver and the transmitter. By using two phase-locked loops, the expense and complexity of a microprocessor or Direct Digital Synthesizer is avoided.

Signals from the antenna must pass through a low-pass filter and a bandpass filter before reaching the diode mixer. The bandpass filter is approximately 300 kHz wide. The ARK 40 really holds its own during the nighttime SW broadcast station QRM, thanks to the excellent front-end filters. There is no RF gain control.

AGC amplifier. The AGC provides good control of the audio, without a lot of pop and click. There are no clicks or thumps during keying. The AGC action is one of the nicest I've used in a QRP rig in some time. A MC3361 IC is used as a product detector and BFO.

By flipping the audio filter on, you insert a 200 Hz filter into the audio chain. Audio is provided by an LM386 audio amplifier. A sine-wave sidetone generator is injected into the audio line during transmit. The sidetone volume tracks with the front-panel audio gain control. You cannot change the tone of the sidetone.

On the transmitter side, again the synthesizer provides the necessary signals required by the transmitter preamplifier and the MRF-476 final. The final is biased as a Class-C amplifier. To steal a bit of thunder from my computer hacker friends, the transmitter is "what you see is what you get." The transmitter does not "shift" down in frequency when transmitting. If you have dialed up 7.040, you transmit on 7.040.

A relay controls the T/R functions of the ARK 40. This relay supplies the required transmit key voltages and toggles the antenna between receive and transmit.



Photo A. The ARK 40 QRP transceiver.

By generating a 19.0000 to 19.1500 MHz signal on the synthesizer board, and then injecting it to the mixer on the transceiver board, the result is a 12 MHz IF frequency. The IF filter consists of four matched crystal filters. The output of the crystal filter goes to a variable gain amplifier controlled by the

First Impressions

It's true what they say about first impressions. Opening the box of the ARK 40 proved that old saying once again. I'm impressed! The kit contains all the parts you need to fully

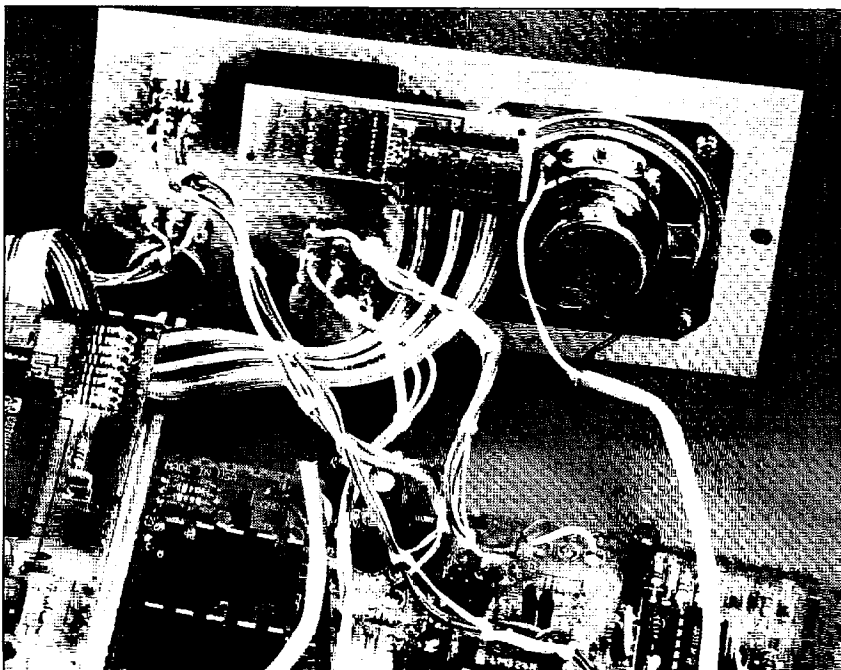


Photo B. Front panel wiring on the ARK 40 is kept nice and neat with waxed cable lacing.

assemble the ARK 40. The only thing you have to add is your time and some solder.

There are two main PC boards in the ARK 40, plus one smaller PC board for the thumb-wheel buttons. The synthesizer board and the transceiver board are both the same size. Each PC board comes sealed in its own package with all of its parts. This way, you won't get the parts from the transceiver board mixed up with the parts for the synthesizer board. Both boards are double-sided with plated-through holes. The parts placement guide is also silk-screened on the boards. The boards also have been solder-reflowed, which makes soldering the parts in much easier.

Putting It Together

There are a lot of parts to the ARK 40. If you've never assembled a kit before, you'd better pass on this one. It's not a kit for first-time builders. If you don't know which end of a diode is which, don't try the ARK 40. You should be comfortable working with double-sided PC boards and ICs. You should also be able to remove a part properly should the need arise. Removing parts from a double-sided PC board can be a real pooper!

Time is the one element on your side. If you take your sweet time this can be an enjoyable project. Kits *should* be fun! I had a good time with the ARK 40 on my workbench. In fact, I find it very relaxing to assemble electronic kits. My wife calls it "solder-fume therapy." I assembled my unit during my Memorial Day vacation. The manual states it takes about 16 hours to complete, and I think that's about right. Take your time and you'll enjoy yourself.

Construction begins with the synthesizer board. One of the first things that really

caught my eye was the quality of the parts used in the kit. There are ICs supplied by Harris, National, and Motorola. The same goes for the transistors—they really are marked 2N3904 instead of some off-the-wall surplus part number. All the parts are first-rate and there are no surplus parts used anywhere in the kit. In fact, as I found out later, even the SO-239 antenna connector is supplied by Amphenol; this is no hamfest special.

Because there are so many resistors in the kit, that's where you start construction. Now, either my eyes are getting bad or I'm getting old, but I had one hell of a time telling the value of some resistors from the rest. The violet and the brown on the resistors looked so much alike I ended up getting several in the wrong location. The violet paint must have been rather watery, and it sure looked a lot like brown to me. Take it from me: When building the ARK 40, measure the value of the resistors you're not sure of before soldering them in place.

The kit contained many surprises. The 10k and 1k resistors are packaged separately from the rest of the resistors. This way, you don't have to keep wading through the pile looking for them. The same can be said about the capacitors: All the 0.1 and 0.01 capacitors are packaged separately from the other capacitors. You have no idea how much time that saves in building the ARK 40.

The layout of the PC boards allows you to stuff the board like you're reading a newspaper. Starting from the top left, you go down the board until you hit the bottom, then start back up at the top middle and repeat until all the parts are installed. This way, you won't spend all day long looking for R34 after you install R33. That's because they're right next to each other on the way down the board.

This procedure holds true on both the PC boards, with some slight differences.

On the foil side of the synthesizer board you must install four surface-mount capacitors. They're mighty small, but if you follow the instructions you'll have no trouble soldering them in. S & S Engineering even gives you an extra cap in case you cook one. Don't open the packages holding the surface mount caps until you're ready to install them. There is no way you'll be able to tell one value from another once they are out of their packages. Open only one value at a time, solder them in, then open up the other package.

Coils and Toroids

No one I know of likes to wind coils. So, you can relax with the ARK 40 as all the coils come pre-wound and each type comes packaged in its own little bag. You won't have to count turns of wire on a toroid to determine if it's T4 or L6. In fact, some of the transformers come with the leads pre-formed so you won't get the phasing out of whack. If you do get confused, then you can always go to the oversized drawings which show you how to double-check the coils and install them properly.

Wiring the front and back panels consumes a lot of time with this kit (and with most kits, for that matter). Take your time and you'll have no trouble with the connections. The wiring harness is color coded; it makes connections to the controls and the PC boards easy. Waxed cable lacing cord keeps the wiring from the front and rear panels to the PC boards nice and neat. I cheated here a bit and used nylon cable ties on the rear panel only. The front panel wires I laced up. Cable lacing adds a touch of class to the kit.

The Manual

Any kit worth its salt *must* have a strong manual. S & S Engineering should be very proud of the ARK 40 manual. There are the usual step-by-step instructions, but the manual doesn't go into such fine detail as Heathkit does for installing components like electrolytic capacitors.

The manual features fold-out schematics for both the transceiver and the synthesizer. Oversized PC parts placement guides, as well as foil side only overlays, are included. These overlays come in very handy when installing the surface mount parts.

S & S Engineering printed their manual on quality paper and bound it with a spiral binding so it will lay flat on your workbench. There are plenty of oversized drawings to clarify the mounting of many parts. This is especially useful with the transformers used on the transceiver board. Full-sized photos complement the drawings, so you won't install a wire in the wrong place. I found the photographs especially helpful when soldering the thumb-wheel to its small PC board. If you get this part on backwards (and that would be easy to do) it would be almost impossible to fix. The photographs show exactly how it's installed on the thumbwheel.

But, even with the manual as good as it is,

there were several spots that confused me. Watch carefully the placement of the IC sockets on the transceiver board. The control relay IS mounted in a socket.

Also, I would like to have seen the step-by-step assembly instructions moved from the back of the manual to the appropriate area in the text. For example: The synthesizer board starts on page 3-1, but the check-off list for parts begins on the very last few pages. I had to flip back and forth between the steps up front and the parts check list in the back.

The manual has a very good section on theory of operation on both the synthesizer and the transceiver boards. It's well worth your time to read through these chapters. There's even a chapter on soldering!

There are also several pages on troubleshooting the rig. I would like to have seen an overlay of the PC boards, with transistor voltages listed, to help track down problems.

Alignment and Tune-Up

Although you can align the ARK 40 without fancy test gear, it would be worth your while to have a frequency counter and perhaps a scope, too. A good DVM is required, as is a power supply capable of 2 amps. A wattmeter and a 50 ohm dummy load will be required for tuning the transmitter. Alignment is very simple and straightforward. You simply check for the proper operation of the translation oscillator and the loop oscillator. A counter is best here.

The transceiver PC board requires minor tweaking to get it to operate. There are only two coils to adjust and two small trimmers to tweak. Again, a frequency counter would come in real handy to set the BFO frequency.

Sometime the Dragon Wins

The tune up went smoothly until I reached the transceiver board. The receiver showed no life at all. I could hear my test signal in the speaker, but that was all she wrote. After doing some rough tests, the receiver's mixer seemed to be dead. The audio chain worked and all the inputs from the synthesizer were there. But a call or two to S & S Engineering brought a quick solution to my troubles. Several areas were pinpointed and I went back to the workbench armed with new knowledge.

After a bit more looking I found the problem. It turned out to be a super-thin sliver of copper on the PC board on one of the pads touching the ground foil, shorting out the input to the mixer. The pad is sooooo close to the ground foil that during the board's etching process a tiny piece did not etch away. A sharp knife cut the sliver away from the ground trace. That fixed the receiver and I was golden. Give S & S Engineering an "A" for support.

I notified S & S Engineering about the sliver and they promptly checked all in-house kits for the problem. No others were found, but this shows the attention this company pays to customer service.

On the Air

Operating the ARK 40 is, by design, simple! With only two controls, volume and RIT, you select the frequency you want with the push-buttons, then transmit. It really is that simple. Oh, but it does take some getting used to pushing buttons to change frequency, instead of twisting a knob. I found moving the 1 kHz button up and down the best way to hunt for stations. The buttons are small, and it's easy to go past what you want to tune in. After awhile, tuning with the push-buttons kin-

da grows on you. However, the ARK 40 is a not a contest machine.

This is the only QRP rig in the home-brew club that will allow you to QSY up or down the band with any precision. If you're asked to move up 2 kHz, you can! You can plan a schedule with a buddy back home while you're out in the field and not worry about mistuning the frequency. If you agree on 7.0335, that's exactly where you can go. There is no guessing as to what frequency you're on. It's amazing how stable the receiver is. The ARK 40 does not drift, thanks to the synthesizer. It genuinely is "rock-solid." Of course, some will say even a synthesized rig drifts. That's true, but you would never notice unless you broke out the test gear on the ARK 40.

The MHz digit does not appear on the front panel. So, to "push up" 7.040 MHz, the front panel buttons would read "0400." If QRM is getting rough, then flip on the audio filter. Adjust the RIT to center the signal into the filter, and that's it. The RIT is very smooth and allows you to fine-tune the signal right into the center of the filter. The QSK keying works very well. However, the relay is a tad on the loud side.

Every station I worked commented on the nice CW tone. The ARK 40 keys very well. The sidetone is pleasant to listen to, even after a long-winded CW contact.

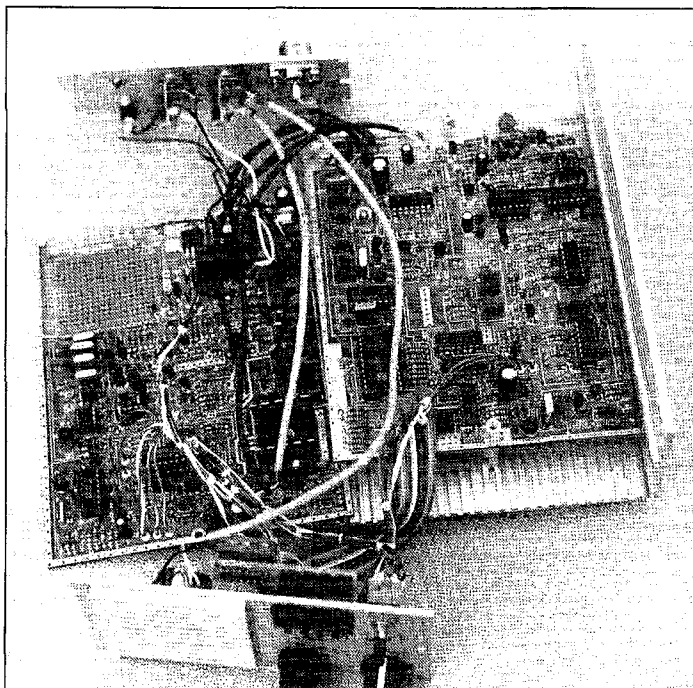
The front end keeps most unwanted signals from creeping into the receiver. The matched crystal filter did an effective job on the 40 meter band. Signals seem to pop out of the air. Switching in the audio filter proved useful in pulling stations out of the QRM 90 percent of the time. The ARK 40 sounds so good on receive that I leave it on all the time.

The ARK 40 would be quite happy at home or in a backpack. On receive, it draws 380 mA and my unit produced a fat 5 watts at 1.12 amps. The supply voltage is 13.8 volts. Of course, on a 12.5 volt battery, you'll get a little less RF output. You could run the ARK 40 with one or two 7 amp/hour gel batteries in the woods. A small solar panel is all you would need for long-term use in the field.

With its extruded aluminum case, the ARK 40 is military-grade solid. One would have to try hard to damage it. In fact, had the front and rear controls been waterproofed, I'd take it white water rafting and leave the baggies at home.

So what's the bottom line? The ARK 40 is exactly what the QRP enthusiast (or any ham, for that matter) needs: a simple-to-use monoband rig. S & S Engineering provides you with a rig that produces enough kick to make contacts with less than perfect antennas, while providing the luxury of a fully synthesized transceiver. If you enjoy building kits and like operating with today's technology, you can't go wrong with the ARK 40.

What I would like to see next is a small antenna tuner and switching power supply in the same size case as the ARK 40. A pipe dream? Perhaps, but then who knows? **73**



The ARK 40 is not a kit for beginners.

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Amateur Radio and Amateur Solar Astronomy

There's going to be an annular solar eclipse on 10 May 1994. Solar eclipses are spectacular astronomical events in which the moon passes between the earth and sun, temporarily blocking the sun's rays from reaching earth. For a few minutes, the swath of the earth along the eclipse path is bathed in darkness. A total eclipse occurs when the perceived diameter of the moon is such that the sun is totally covered, except for the corona. An annular eclipse, such as the one next May, occurs when the apparent diameter of the moon is smaller than the sun, leaving a ring of light hanging in the sky. Radio propagation is affected by the solar eclipse because, for a brief period of time, the source of energy that causes ionization is interrupted so the average electron (e^-) density changes. The e^- density in the F-layer determines the maximum usable frequency (MUF), while the e^- density in the D-layer determines

the lowest usable frequency (LUF). Figure 1 shows the path of the annular eclipse that will be seen next May . . . note the times are in U.T. (i.e. GMT or "Zulu" time).

What Kind of Ham Experiments Can Be Done?

A review of the amateur radio literature shows that a number of formal experiments and observations have been performed during eclipses over the years. As you will see, there's plenty of real science that you can do with your radio.

Schellenbach (1970) describes observations made on the 40 meter ham band during the eclipse of March 7, 1970. He erected a 1 λ horizontally polarized wire antenna that had four main lobes spaced at 54 degrees from the wire. The antenna was erected at a height of $\lambda/2$ in order to place an elevation lobe at about +30 degrees to optimize D-layer observations. Schellenbach observed a 25 kHz portion of the 40 meter band, working stations and observing signal level changes as the eclipse passed over the land.

Another observation of the 1979

eclipse was reported by Kennedy, et al. (1972). This experiment was performed on the 75 meter amateur band, using CW emissions. Stations 190 km apart arranged to use identical special transmitter keys that would produce a two-second signal on 3,570 kHz every four seconds; the two stations alternating sending signals to each other. The receivers of the stations had the automatic gain control (AGC) function turned off. Output levels were measured with an AC multimeter connected across the speaker connections. As a precaution against ground wave contamination of the data, the antennas of the two stations were oriented end-to-end, so ground-wave signals would be off the nulls of the antennas. The data collected consisted of groups of 10 two-second transmissions, spaced four seconds apart, at intervals of one to two minutes. The 10 pulses in any one group were averaged, and the averages of the groups were compared. A maximum signal change of 17 dB was noted. The two stations took data for a week prior to the eclipse in order to establish a normalized data set.

Menzel (1976) discusses potential observations of the effects of the eclipse of 23 October 1976 on propagation in the upper HF region, i.e. the 10 through 20 meter amateur radio bands. It was noted by Menzel that

during the period of the eclipse there would be a brief return to nighttime propagation conditions for communications paths along, and either side of, the eclipse totality path. This same type of observation is open to short-wave listeners (SWLs) as well as ham operators. The ham operators have a definite advantage, however, because they can schedule contacts with stations in the regions of interest, and don't have to await stations of opportunity to appear. Like Kennedy, Menzel recommends that amateur operators set up schedules for a week prior to the eclipse, at the same time of day, in order to establish a baseline of signal level averages. Otherwise, the measurements made on the day of the eclipse would be less usable.

Johnston and Johnston (1979) performed radiosolar observations of the 26 February 1979 eclipse that crossed the northwestern United States and the western provinces of Canada. They were part of an experiment that used the 75/80 meter band. A set of 12 stations participated, six transmitting in rotation on a two-minute schedule, and six monitoring the others. The transmitting stations sent a five-second identification (call-sign), followed by a two-second quiet period to establish ambient noise level, and then held the key down for 12 seconds to establish signal levels.

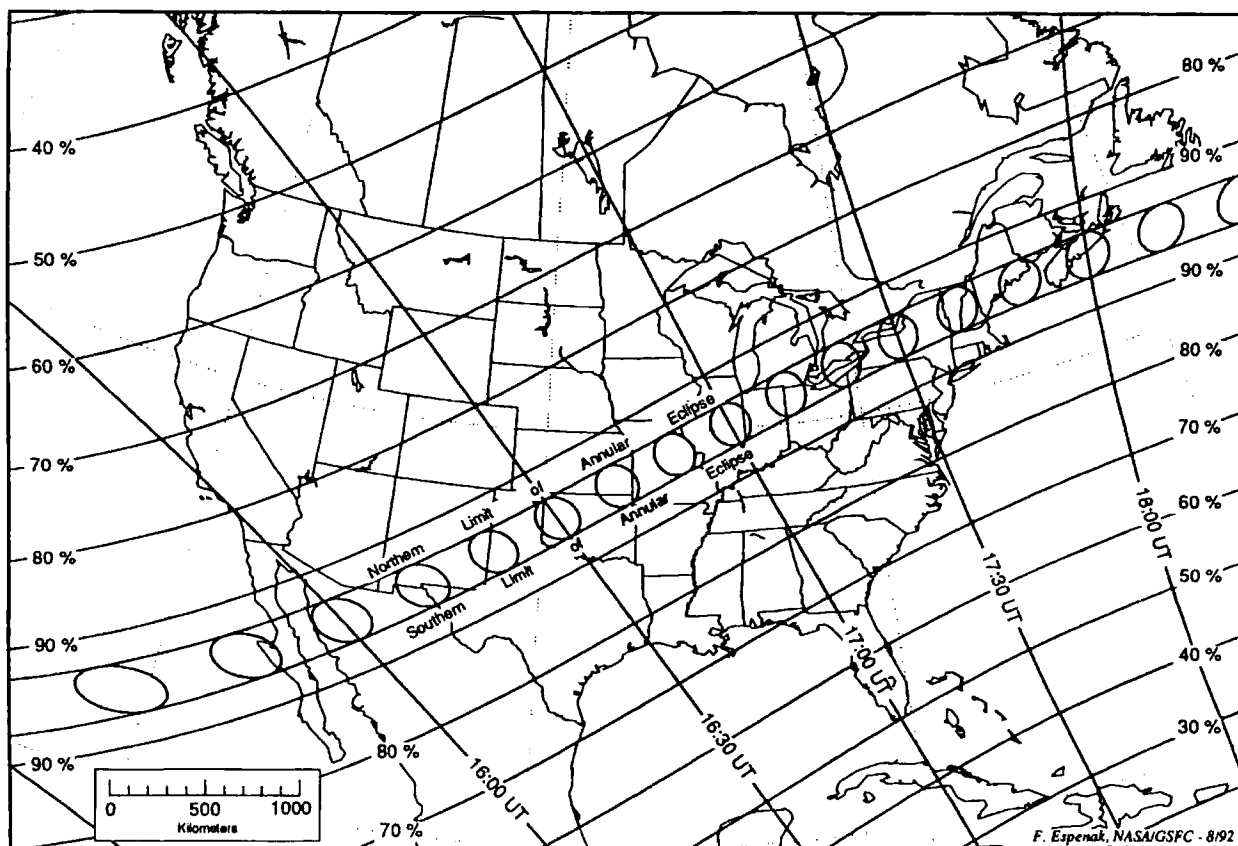


Figure 1. Path of the solar eclipse (from a NASA publication).

Receiver S-meter readings were used to establish levels. They observed the effects for three hours, keeping time records in universal coordinate time (UT) through radio station WWV transmissions.

An alternative to using amateur transmitting stations was reported by Smith (1979). He used observations of WWV and several 50 kW AM broadcast band stations to study the propagation effects of the eclipse.

Lewis (1979), in a report preceding the 1979 eclipse, reported on his own literature search. He reported that a Canadian team of scientists at Fort Churchill, MB observed the 20 July 1963 eclipse. In that event, 94 percent of the solar disk was covered. The Canadians used sounding rockets sent to an altitude of 200 km to measure electron density, temperature, ultraviolet and X-radiation. They found that the e- density in the D-layer dropped proportionally to the percentage of the solar disk eclipsed, starting within approximately three minutes. In the E and F1 layers, however, it was found that the e-densities decreased but it was NOT proportional to the percentage of eclipse. The team believes that this nonlinearity is due to the fact that X-radiation is emitted largely by the sun's corona, which is not eclipsed. Such radiation is largely attenuated by the time it reaches the D-layer, so

the effects in that region are more linear.

A group in Urbana, Illinois, USA, used a 2.66 MHz ionosonde instrument to observe a 60 percent eclipse on 10 July 1972. They noted a large decrease in e- at distances of 75-80 km.

the MUF for that day. Estimations of the MUF can be gleaned from the propagation prediction columns in amateur radio and shortwave listener monthly magazines, or from the MiniMUF software.

For eclipse monitoring, use frequencies that are most affected by

burned into their eyesight forever. And if they use a telescope or binoculars to look at the eclipse, then immediate destruction of the eye-sight will occur. If you absolutely MUST look at the eclipse, consult an ophthalmologist for advice on methods and materials that will save your eyesight.

"Observing solar eclipses by eye can be very dangerous! Don't look directly at the eclipse, even briefly. Indirect methods can be found in amateur astronomy books."

Australian researchers observed the eclipse of 23 October 1976 (see also Menzel 1976, above). The Australian observations measured the angle of arrival of 2.5 MHz signals from a station 69 km away. They noticed a "... pronounced oscillating tilt" of the E-layer at 100 km, which lasted some 40 minutes.

Some General RadioSolar Observation Advice

When looking for shortwave fade-outs from SIDs, take advantage of the fact that absorption varies with the square of the frequency (F2), so observations should take place on a frequency as close as practical to

the D- or E-layers of the ionosphere. Lewis recommends using frequencies that are most affected by D-layer, so he prefers frequencies in the 75/80 meter band, or near 5 MHz. He claims that the greatest signal enhancement will occur just before totality reaches the receiver observation site.

WARNING!

Observing solar eclipses by eye can be very dangerous! Don't look directly at the eclipse, even briefly. Indirect methods can be found in amateur astronomy books. Every time an eclipse occurs, it seems that we hear stories of people who look directly at it, only to have the image

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Getting Started with TCP/IP

[This series of articles explains how to set up a working amateur TCP/IP station. This first installment will sell you on the idea; next month we'll get started with the software itself. The software needed is all available free from many sources (reliable ones will be listed where available). Much of it will be available from the 73 BBS (603/924-9343), though those of you with access to Internet FTP are much better off using it when possible. Some of this first installment is a review of things you may have seen before—for this I apologize. I wanted to be sure that the series was complete.]

So many of you have written—by paper mail and electronically—asking about TCP/IP and ham radio that I have decided I had better write something about how to do it before you start showing up at the door. This series of columns is designed to give you an introduction to TCP/IP over radio, and some how-to-do-it informa-

tion. The BEST way to get started in TCP/IP is to find someone who is already using it, but I'll do my best to explain the ins and outs to the shy and isolated out there.

What Is TCP/IP?

TCP/IP (Transport Control Protocol/Internet Protocol) is a networking scheme developed by ARPA (The DoD's Advanced Research Projects Agency) to make possible the huge collection of computers, cables, routers, and all sorts of other boxes known as the "Internet." The Internet (note the big "I"), is worldwide and carries a mind-boggling amount of data each day. Nearly every university, large company, small technology company, and government agency is connected to the Internet.

Amateur radio is also connected to the Internet, and amateurs worldwide use the resources available there for communications and database services. In fact, as amateurs we have our own network: 44.xx.xx.xx. Any IP address starting with "44" is some sort of amateur station. (We'll look at how addressing works later.) This

44.xx.xx.xx network lets amateurs send mail to (and connect to) stations all over the world. Internet-based services such as the Ottawa converse bridge—which allows real-time chat among hams from all over the world—and the Call Sign server at SUNY Buffalo—containing up-to-date callsign records for all US hams—count on the landline connectivity of the Internet to bring you their services.

Some amateurs will tell you that TCP/IP is not ham radio because it uses landline-based resources. To these self-appointed guardians of the ether I say, "Phooey." (Pretty eloquent, eh?) If you don't like it, don't use it—but leave those of us who want to move into the 20th century alone. Those of you running full-service PBBSs take note: The Internet moves packet traffic—fast! More and more stations acting as gateways from the landline-based Internet to the various radio LANs across the country mean fast, error-free routes for your forwarding, if you know where to tie in.

All of these resources and more, are available through the TCP/IP protocol suite. TCP/IP is a protocol—a set of rules—by which communications of various types can be accomplished. If you are familiar with the idea of "diplomatic protocol"—the set of rules that govern the behavior of government representatives dealing with each other—then you have some idea of what I am talking about. With TCP/IP, stations have a way of contacting each other, establishing a communications channel, and packaging data for transmission.

What About Amateur TCP/IP Over Radio?

In 1989, Phil Karn KA9Q released a program called NOS to the ham community. This program was a first attempt at implementing TCP/IP for use on IBM-PC compatible machines for use over radio. It was—and in many respects still is—an experiment. KA9Q's NOS still provides the *kernel*—a technical term for the heart of an operating system—for the various implementations of TCP/IP hams use today. Since Phil provided the source code to NOS, many ham programmers took the torch and began to develop variants. Today, the resemblance to the original can be remote, but we owe thanks to Phil for his original work—it started a revolution.

Two things make TCP/IP a very powerful networking scheme for amateur radio. One we have already dis-

cussed—the wealth of the Internet. When we use TCP/IP over the air, the use of the landline-based Internet resources is automatic and transparent—like going to a cafe in France and ordering in French. The other is the protocol itself. TCP/IP is based on the idea of services. Each of its various features is a *service*, and is accessed through a *port* or *socket*. This arrangement makes everyone both a client (user) and a server (provider) if they want to be.

TCP/IP Services

There are four services which amateurs will find themselves using most frequently. These provide ways of connecting to other stations and transferring data. These services are the same no matter how you get to them—phone line, Ethernet network, or radio.

Telnet

The telnet service is the workhorse of the TCP/IP environment. Telnet allows a client to start a terminal session at a remote server across the network. In other words, you can login to a remote machine—wherever it happens to be—if it is reachable from your network. In the ham community, telnet is generally reserved for accessing database servers and the like. (See Figure 2 for an example. Telnet was used to reach this Internet resource.)

Telnet can also be used to login to another ham's station in order to use the mailbox there or other resources that might be provided. To continue the call server example, some NOS implementations now support CD-ROM-based callbooks. This could be accessed via telnet.

FTP

The File Transfer Protocol Service allows clients to download or upload files (binary or text) from an FTP server. This is an interactive system and allows the client to change directories, list them, and select file(s) to receive. Batch downloads are supported. If you have tried to download files from an AX.25 station you know it can be frustrating. FTP works like a charm. Recently, a friend downloaded about a quarter of a megabyte of files from my machine—at 1200 baud—in about an hour.

Finger

The finger service allows a client to get information about a particular system or user. The command:

```
*** connected to 128.205.32.2:2000
Calibook v1.3 Bug reports to bowen@cs.buffalo.edu Type
'help' for help
>> call w2nsd
Call-Sign: W2NSD Class: ADVANCED
Real Name: WAYNE GREEN II Birthday: SEP 3, 1922
Mailing Address: WGE CENTER, PETERBOROUGH, NH 03458
Valid From: AUG 11, 1987 To: AUG 11, 1997
```

Figure 2. The Call Server at SUNY Buffalo provides up-to-date callsign information. Here we look up an obscure callsign to test the database. This is one way amateurs take advantage of landline-based networks. See the text for more.

```
Conference @ IndianaU Type /HELP for help.
/w
User Host Via Channel Time Personal
nlwwo IndianaU 0 0:12 Jeff in Franklin IN
pelmvj westland Ottawa 0 0:12
n8rhv Detroit_MI Ottawa 0 0:10
ve3wzs TorontoBBS Ottawa 0
n5uhb LasCruces Ottawa 44 0:07
n8fkv Detroit Ottawa 5729 0:01 Ken in Livonia, MI
dg3mkc westland Ottawa 5729 0:00
dl3ned westland Ottawa 0 0:00
n8lfj Detroit Ottawa 5729 23:56 Ian - Livonia, Michigan
ke8mk Detroit_MI Ottawa 5 23:54 Frans Rochester (STBY ON7KO)
k5di LasCruces Ottawa 44 23:54
vk3az OzHub Ottawa 0 23:52 Peter Melbourne Australia
wb6jkw Detroit Ottawa 0 23:51
ve3tie TorontoBBS Ottawa 0 23:49
n8taq Detroit Ottawa 5729 23:48 David in West Bloomfield MI
n5faz LasCruces Ottawa 44 23:45 paul el paso, tx
vk4knt Brisbane Ottawa 0 23:37
wb4hin Ottawa Ottawa 0 23:35
aa5df LasCruces Ottawa 44 23:32 Tim doing homework
ve3kpb TorontoBBS Ottawa 44 23:18 Paul in Oshawa
ve3uzg Vancouver Ottawa 0 22:48 Art in Ottawa
kb9fus BBS@k9iu.ampr.org
***
<ve3wzs>: Is anyone receiving my msg? I have just registered as
a user & not
quite sure
<ve3wzs>: How things work.Mike VE3WZS
<ve3uzg>: rgr 3wzs, copy in Ottawa..
```

Figure 1. A typical Sunday afternoon on the converse bridge. It's very late in Europe, or you would see more stations from there. Thanks to the Internet, local converse bridge programs from all over the world are linked together in a big party line. See the text for more.

finger n1ewo@k9iu.ampr.org

will cause the client machine to connect to the finger server at K9IU and make an inquiry about N1EWO. K9IU will then return an informational message about the user N1EWO, providing an informational message whose content is dependent upon K9IU's configuration.

Finger can also be used to provide other sorts of information. For example:

finger weather@iugate.ucs.indiana.edu

returns a weather report for Central and South Central Indiana.

Converse

This service is VERY popular. You can see an example screen from the Ottawa converse bridge in Figure 1. The converse bridge can be a local service, or it can be linked with other bridges over whatever comm link is available. This service is a great deal of fun, and can be truly useful for emergency nets when administered properly. (Those of you who have Internet connections already will find the bridge at 44.135.96.7 3600. You must connect from the amateur net: 44.xx.xx.xx. Connections attempts from any other net will be ignored.)

Yet Another Service . . .

One more service to mention is

called SMTP (Simple Mail Transfer Protocol). Through SMTP, amateur stations can forward their own mail! No more need to login to some remote

Once again we are in France speaking French—these two protocols come from the Internet, and so work perfectly across it and with the

***"If you don't like it, don't use it—
but leave those of us who want to
move into the 20th century alone."***

station and read your mail; SMTP and its cousin POP (Post Office Protocol) will allow every ham to be his own postmaster.

SMTP will automatically forward, through a specified route, any mail addressed to any amateur it knows. It happens transparently, and so easily it seems like magic. With SMTP, you create the mail ON YOUR MACHINE. That's right, you don't login to another machine—you use your own. That is the way things should work.

POP is an alternative to SMTP and makes sense for those who cannot dedicate a machine to running TCP/IP all the time. Like SMTP, POP allows you to use your machine to create messages, and will route them automatically. Unlike SMTP, though, POP calls a post office (another system on your network) and uses a batch technique to send and receive messages. This way, you can check for mail at your post office whenever you start up your system.

machines on it. This means that Internet resources, like list servers which automatically route messages to special interest groups, are available the ham.

OK, OK, I'm Convinced— Now What?

I told you this was a series of articles, and that I would help you get started, so here it is. We will be working with a piece of software called JNOS. This is a variation of KA9Q's NOS, and is available from several sources. The version you will need is 1.08c. I chose this software for several reasons, and there will be those who will argue that it is not the best choice. Here are some of my reasons:

1. It is stable, and still a "live" product. Johann WG7J is still working furiously on new versions, so it will grow as TCP/IP does.

2. It has a decent user interface, but also provides everything that you need to run a full-service PBBS. This

way I can help both the PBBS operator and the average user to get started.

3. I like it, I use it myself.

So, to get started you have to have the software. Those of you who have Internet FTP access will find the program at uscd.edu for anonymous FTP. Those who do not will find it on the 73 BBS, in the packet files area. You will also find the program on ham BBSs around the country. Remember, you want version 1.08c. You will also need a TNC that will operate in KISS mode. If you are unsure of your particular TNC, check the manual. Those of you running BayCom (or equivalent) modems may be able to run JNOS with a special driver. If you want to try, mail me and I'll explain.

Your homework is:

Get version 1.08c of JNOS.

Get a valid TCP/IP address. To do this, contact your local ampr coordinator and ask for one. If you need to find out who your coordinator is, send me mail at either:

Internet:

jsloman@bix.com

or

packet:

N1EWO@N0ARY.#NOCAL.CA.US
A.NOAM

Next month, we'll look at how to set up the software and get that TCP/IP stuff working. 'Til then, 73 de N1EWO.

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More on the Amiga

I have been taken to task. I admit it, and I accept the criticism, and I will tell you all about it.

In July, I related the remarks of a ham who told us about his "friend who is a confirmed satellite QSOer. This guy has very elaborate radio equipment, but is using a C-64 for tracking and decoding. Until now, the bit rate has not exceeded 1200 baud, so he has been able to get away with a C-64. Soon, however, things are going to change. The new packet satellites will operate at 9600 baud, and my friend will have to change computers.

"This person will not use a computer for anything other than amateur radio. Therefore, I would like the changeover to be as inexpensive as possible. Is it possible that a Commodore 128 could read and write ASCII at 9600 baud? If this were possible, I believe that he might be able to continue to use his disk drive and printer.

"I feel certain that an Amiga A500 could do it, but I hesitate to recommend a computer which is now an orphan. Please roll this around and let me know what you think. Perhaps there are readers of the column who are facing the same choice."

In my response, I indicated that a PC clone would be a good choice. One of our readers, who wishes his name not be printed, is upset with our "lack of knowledge about Amigas."

"First of all, the Amiga is most definitely NOT an orphan, not even the A500. There are upgraded machines

and an improved operating system. Because of the Amiga operating system's construction, NONE of them have been orphaned. The new AGA (Advanced Graphic Architecture) models are the Amiga 1200, and the Amiga 4000, which Commodore has just spent millions to develop. The older models are the 500, the 2000, and the 3000. Ask the video industry about the Video Toaster . . . they will be surprised to know that the Amiga is an orphan, which is what your column implied. Almost all software that is written for the new Amigas will work on the older models, including terminal programs, ham radio software, graphics software, etc."

He goes on to elaborate on published reports of the "death" of the Amiga which, as with the case of Mark Twain's death, are apparently exaggerated. All in all, he makes a strong case for the Amiga as a capable machine, with a mature multitasking operating system, and a plethora of features built in.

Now, I would like to point out that it was not I who called the Amiga an orphan—I was quoting a reader, much as I quoted our Amiga supporter this month. As to why I have not written more about the Amiga to date, I have heard precious little about it from the readers of this column. Wayne has mentioned the Amiga in his editorials, including the Video Toaster.

I looked back over the last few years of "RTTY Loop" to see just what coverage the Amiga has received. In March 1988 I printed a simple terminal program for the Amiga. In August 1988 a copy of a public domain program for the Amiga was offered for a blank disk

and a mailer, through another reader. November 1989 brought the note that "Amiga users are also on the rise, with Amiga Users Nets on 10 and 75 meters, as well as a number of Amiga users on 20 meter AMTOR." Another user was highlighted in March 1990 with the comment that "hams using Amiga computers seem a bit more versed on the intricacies of this mode." A listing of shareware and commercial RTTY programs for the Amiga was given as well.

So, look'il. I have not ignored the Amiga. For that matter, if you look back in this column, I have not ignored much. How much coverage I give to a given system is directly proportional to how much input from the readers, and even from manufacturers, I get. So, stay tuned, be vocal, and let me hear from you!

Other Questions

Here's a question, for example, from George Lemaster WB5OYP of Falls Church, Virginia. He wonders where one can get a diagram for the Dovelron adjustable filter RTTY demodulator, model MPC-1000T. Somehow, I am sure that some reader, somewhere, can help out.

He also asks about the HAL ST-8000 spectrum display. He'd like to make a scope display which would give an indication of the modulation frequencies and/or FSK type modulation. Once again—anybody?

Finally, here's another request for help, this one from the other side of the globe. Michael Mihailovic VK2OZ in Sydney, Australia, tells of his recent acquisition of a 1984 vintage Kantronics Universal Terminal Unit. He needs help finding a terminal program to run the unit, one with transmit buffers and a type-ahead facility. He wonders if anyone is still using this decade old unit.

He also relates that although he has the operator's manual, he is missing the "Introduction To and Operation of

AMTOR" book that originally came with the Kantronics UTU. He would like to have this book to get onto AMTOR, but is having no luck locating a copy. Kantronics told him, he says, to contact a local Australian agency, which had no idea what he was talking about. If a copy of this book, one would presume even a photocopy, is lying around, this is one amateur who would be very grateful. I would be happy to forward any such material to him, and look forward to hearing from you, out there, who can help.

One of the programs in the RTTY Loop Software Library may well be at least the software answer to Michael's problems, or even yours. The collection continues to grow, with three disks of RTTY/ham software and one of archiving utilities. I try to always include the latest versions of programs available, so even some of the basic disks are subject to updates. A self-addressed, stamped envelope, or an Email note, will get you a listing of all the programs and disks. Each collection pretty well fills a 1.44 Mb disk, and is available for \$2 per disk to be filled, sufficient blank media, and a self-addressed, stamped disk mailer for return to you. As always, Email to me on CompuServe (ppn 75036,2501), Delphi (username MarcWA3AJR), or America Online (screen name MarcWA3AJR) is the quick and easy way to reach me. Postal service hard copy to the above address is fine, too. Just be sure to enclose a self-addressed, stamped envelope if you would like a personal reply. If you would like to put your two cents in, and don't want your name printed, that's fine too, as long as you tell me who you are! I won't print or pay much attention to an anonymous letter, but I will respect your request for privacy if you like. Above all, write me! This column reflects the interests of its readers, and I read those interests through your letters. I look forward to hearing from you.

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Foxhunt Fun at the Friendship Games

"An unstable weather pattern is returning to southwestern British Columbia." The weather radio voice coming from my wife April's scanner was discouraging as we awoke on Wednesday, June 23, our first full day in Victoria. Summer showers are the rule rather than the exception on the western Canadian coast, but we were hoping for better conditions for the 1993 Friendship Radiosport Games (FRG-93), just two days away.

Heavy rain had pounded our rental car as we waited for the ferry from the mainland to Vancouver Island the previous day. Such a storm during the FRG-93 radio direction finding contest (the foxhunt) would not be welcome.

To the green-thumbed residents of Victoria, abundant rain makes this provincial capital a perfect place to live. Flowers are everywhere. You see them on lawns, in gardens (called "rockeries") and hanging in uncountable numbers of baskets. We admired them as we made a get-acquainted

trip to Thetis Lake Park, the foxhunt venue. We then drove to the Carey Road campus of Camosun College, where special events station XO7G had been active for several weeks.

Station Manager Al Fast VE7XZ was proud of XO7G, but April and I wanted to visit another of his hamshacks that is just as special. After a short drive we arrived at XO7GRH, in the rehabilitation unit of Gorge Road Hospital. Al introduced us to two of the patients who put this station on the air regularly using voice, CW, and packet.

Like other stations in Victoria, VE7GRH was using the special XO7 prefix made available for the Friendship Games. Al and his friends had installed special adaptive equipment such as oversize switches, voice-read-out rotor controls, and puff-sip keyers to make this station accessible to anyone, even those having no use of their arms and legs (Photo A).

The Mini-Summit

Now it was time to begin last-minute preparations for the Games. We had been invited to the home of Perry (VE7WWP) and Anne Creighton to dine and to finalize rules and procedures for the FRG-93 foxhunt.



Photo A. VE7GRH, the ham station at the Gorge Road Hospital rehabilitation unit, makes it possible for disabled patients to get on the air. This is one of several operating positions.

dures for the FRG-93 foxhunt.

"It's only a couple more places at the table," Perry told us, referring to his current house guests, Evgeny Stavitsky UWØCA, wife Olga, and interpreter Raisa Kucheryavenko UAØCJO. Evgeny is president of the Friendship Amateur Radio Society (FARS) chapter in Khabarovsk, Russia. He led the 15-member Russian delegation to these biennial Games.

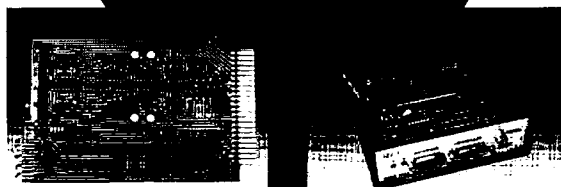
Raisa is not only excellent at her translating duties, but is also a superb conversationalist in her own right. Anne insisted that all radio talk be

postponed until after dinner, so we spent two delightful hours getting acquainted and learning about our respective lifestyles.

After dessert, we got down to business. Although Perry had never entered nor witnessed a ham radio foxhunt, he had agreed to organize this event, as Vice President of the hosting FARS Victoria chapter. Evgeny represented the Russians, and I represented Foxhunt Team USA.

We agreed to follow the International Amateur Radio Union (IARU) guidelines for foxhunting championships as

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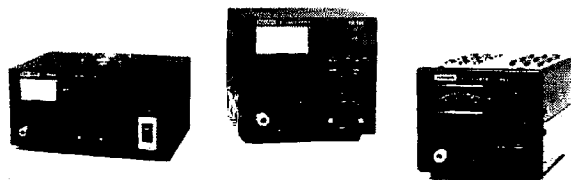
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closely as possible. This 12-page document calls for five "foxes," transmitting in sequence for one minute each. Contestants attempt to locate as many as possible within three hours, carrying a card to mark with the unique punches located at each fox.

Scoring is determined primarily by the number of transmitters found, and secondarily by elapsed time. Contestants are individually timed. They start at five-minute intervals, each coinciding with the start of fox #1 transmissions. This scatters the contestants on the course to minimize "follow the leader" problems.

Successful foxhunters pay attention to the bearings of all transmitters at all times, plotting them on maps provided by the organizers. They also eye their watches, since exceeding the three-hour time limit means disqualification. In other words, it is better to return after 175 minutes with only one fox found than to find all five in 185 minutes.

Each country may field one or more teams of three to five contestants each. Team score is a function of the best three individual scores. Team members are not allowed to help one another on the course. In addition to team medals, corporate sponsor Advanced Electronics Applications provided medals for the top three individual entrants.

IARU rules for foxhunt championships call for separate categories for seniors (males 18 to 40 years), juniors (boys under 18), women (any age—nobody asks!), and "old-timers." Only seniors are required to find all five transmitters in IARU European/



Photo B. Ben Young VE7AJT, the youngest competitor, has just found his first fox and is looking for #2 with one of the Japanese RDF sets.



Photo C. Svetlana Boltchenkova UA0CNE, one of two YLs participating in the foxhunt, leaves the starting corridor. She used a three-element Russian RDF set.

Asian events; others need find only four. Because there was only one junior (Photo B) and two women (Photo C) among the contestants, we agreed

that there would be no special categories in FRG-93. Everyone must attempt to find all five transmitters.

The Russians fielded two teams of

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Photo D. At the Sunday demonstration, Evgeny Stavitsky UWØCA shows a blindfolded ham how to get a bearing with a Russian two-element RDF set.



Photo E. Leading Russian team #1 to the foxhunt gold medal were (left to right) Igor Krivosheev UAØCZ, Mikhail Zavarukhin UWØCN, and Alex Savin UAØCDX. They accepted the award at the Saturday night banquet.

four members each. The three-member Canadian team was joined by Yoshiko Yamagami JQ1LCW, the only participant from Japan. Kevin Kelly N6QAB, J. Scott Bovitz N6MI, and Randy Seybold K5TTE competed from the USA.

By the time our rules were finalized, it was getting late. After the traditional toast of Russian vodka to seal the agreement, it was time to go.

Testing...

Perry was admittedly no foxhunt expert, but he had obtained expert assistance. He had called the VicOrienteers, who hold regular outings in

Thetis Lake Park. Alan Philip, one of the organization's leaders, volunteered to help, and brought several other members for timing and Course Marshall duties. No one knows the park better than Alan, who was chief cartographer of the beautiful 1:15000 topographical map supplied to the contestants.

At orienteering events, contestants navigate their way through unfamiliar wooded terrain using only a topo map and compass, looking for previously placed controls (red and white flags) at locations marked on the map. Radiosport foxhunting is similar to orienteering; locations of flags coincide with

the fox transmitters. (But foxes aren't marked on the map, of course!)

Alan had suggested five fox sites, which we tested Thursday. Total distance around the course would be 4-1/2 kilometers. That's not easy, but it's much less than the 12 km courses common in European championships.

Evgeny UWØCA and April WA6OPS stayed at the start/finish point with radio direction finding (RDF) gear as Perry, Alan, and I carried a test transmitter around the course, braving occasional bouts of rain. At each of the five sites, we determined the power and antenna configuration needed to give adequate signal to the

starting corridor.

Southern California T-hunters (N6MI, N6YKE, and AF6O) supplied the five course transmitters and end-point homing beacon. All used N6MBR TBOX boards (see "Homing In" for October 1991) for perfect synchronization.

RDF Equipment: The Scapegoat?

Everyone agreed that the 1991 FRG foxhunt course in Portland, Oregon's Forest Park had been very difficult. Only seven contestants out of 16 found all five transmitters. The Russians felt the RDF sets supplied by FARS-Portland were partly to blame.

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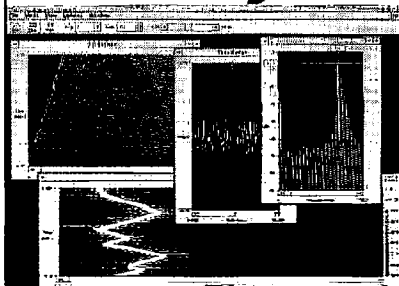
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These dual-antenna units, which work on the time-difference-of-arrival (TDOA) principle, give only direction indication, without strength information.

TDOA sets are susceptible to bearing errors caused by multiple signal paths (multipath). The direct signal competes with reflections from nearby objects, such as hills and trees. When using a TDOA RDF set, it is necessary to keep moving and take bearings very frequently to average out these multipath effects.

The Russians volunteered to provide the competitors' RDF sets for FRG-93. They brought 10 receivers (model Altai-145) from the Barnaul Radio Factory in their country. Altai receiver circuits are cleverly built into the boom of two- or three-element beam of flexible steel tape for safety in the field. There is an AM detector (which also works on FM signals) and a pseudo-BFO that serves as an audible strength indicator for distance estimation.

Altai sets were available for all contestants to use, but some chose to use others. There were a couple of Japanese RDF sets with HB9CV two-element arrays and two of the TDOA units. Russian and Japanese hams have only 144 to 146 MHz on 2 meters, so course transmitters were modified to operate on 145.725 MHz. With no crystal or ceramic filter, the single-conversion Altai receivers are rather broad. But they worked well on this

Gold	Alex Savin UA0CDX	2:07:10
Silver	Igor Krivosheev UA0CZ	2:27:00
Bronze	Mikhail Zavarukhin UW0CN	2:52:31

Figure 1. Individual medalists at the FRG-93 foxhunt and their times to find the five transmitters.

Gold	Russia #1	UA0CDX, UW0CN, UA0CNE, UW0CR
Silver	Russia #2	UA0CZ, RA0CE, UA0CKB, UW0CD
Bronze	Canada	VE7BKF, VE7AJT, JQ1LCW, VE7MAL

Figure 2. FRG-93 foxhunting championship teams and team members.

hunt, except for minor QRM from local packet operations on 145.69 MHz.

Banking Signals Off the Lakeshore

It was our intent that the 1993 foxhunt course be less arduous than 1991's, giving better scores. All foxes were placed near established trails in the southeast corner of the park. Contestants picking the proper 4-1/2 km trail loop would pass close to each one.

Foxhunt Friday brought perfect weather and no malfunctioning of equipment. But to everyone's surprise, scores were poorer than in 1991, overall. Only three competitors found all five foxes. The average was 2.1 foxes found per contestant.

The Russians were clear winners, though they averaged only 3.1 foxes each (Photo E). No doubt their familiarity with European/Asian-style foxhunting and the RDF gear gave them an advantage. But they are also in very good physical condition, when

you consider that their team's average age is 40.

Hunters who didn't do well were probably victims of signal reflections again. This time, however, the bounces came from more distant points. The signal path from fox #1 to the start was unobscured, so most hunters found it. But the direct path from #2 and #3 to #1 was blocked by 200-foot hills.

Sometimes the signal propagated from foxes #2 and #3 by passing over a big lake to the west of the course or a marsh to the northwest, then bouncing off hills on the opposite bank to get back to hunters at the start or at fox #1. In such cases, the classic principle of RDF comes into play: "Your RDF set indicates the direction of incoming signal, which may or may not be in the direction of the fox." Often, it wasn't.

Hunters following reflected signals were drawn into the vast interior of the 2200-acre park. Perry says there is a nude beach somewhere on the

lakeshore. I wonder if any of the contestants discovered it!

Try It Blindfolded

If North American hams are going to hold our own in future European/Asian style foxhunts, we must make them regular events here, to gain experience and to train future champions. To encourage the hams of Victoria, the Russians put on a demonstration Sunday at the FRG hamfest grounds.

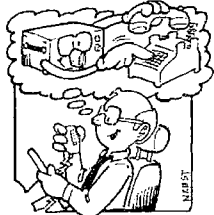
To make it more interesting at this flat, treeless campus, attendees were invited to try finding a fox while blindfolded, using only the audible indications of a Russian RDF set to get bearings (Photo D). What fun—maybe this should replace transformer tossing and QLF (left-foot CW sending) contests at our summer hamfests!

Beautiful scenery, friendly competition, exercise, radio talk, and international goodwill—FRG-93 had it all. I could go on about the CW sending and the pile-up contest, the special events station, and the N6MI/K5TTE QRP Field Day in the park, but I want to leave room for plenty of photos to inspire you to add on-foot foxhunting to your club's RDF activities.

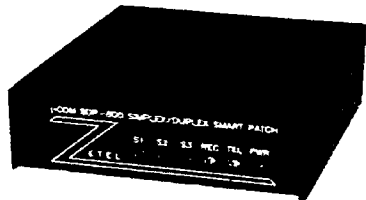
The hams of Khabarovsk, Russia, are hosting the next Friendship Radiosport Games in 1995. You're invited. It's not too early to start training. Let's win some medals and help bring the big FARS traveling trophy back to the USA!

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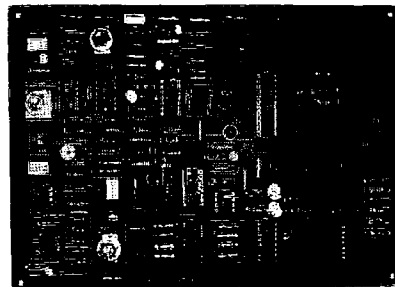
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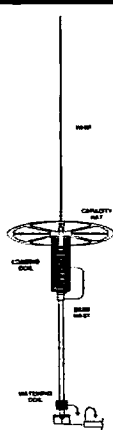
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NASA Resources

There is such a plethora of books, pamphlets, videos, and other resources out there for teachers to avail themselves of that it sometimes seems like an overwhelming task just to categorize and zero in on where to begin looking for needed classroom materials. With that in mind, I'm dedicating this month's column to helping teachers and instructors of amateur radio to quickly locate some of the resources that NASA has to offer.

With more and more schools participating in SAREX projects, the need for highly motivational lessons and materials about space travel and communications is becoming greater. Ever since my school's SSTV contact with Tony England W0ORE on board the *Challenger* in August 1985, I've always included a unit on space and communications in my ham radio curriculum. The materials are always current and overlap very nicely into science and current events studies. My sixth-, seventh- and eighth-graders really love this portion of the curriculum, and it provides fabulous follow-up and enrichment activities in the classroom.

ment activities in the classroom.

On March 2, 1993, NASA's education staff met with five aerospace education organizations for an overview of each of their programs and a discussion of how NASA can work with them in supporting NASA's Strategic Plan for Education. All five organizations have programs complementary to NASA and all support pre-college education.

1. For eight years now, *The Young Astronaut Council* has targeted students in the K-9 age group. The Y.A.C. supplies space-theme curriculum packages and a teacher's handbook for \$40 annually. Chapters are often funded by community groups such as the PTA, Kiwanis Club, Civil Air Patrol, and Air Force Association. The Council now offers a "distance learning" program using satellite technology to beam space curriculum programming three days a week from their Spokane, Washington, uplink. The Council also recently developed curricula, specifically targeted to reach minority students, through funding from the National Science Foundation. For further information, contact The Young Astronaut Council, 1308 19th St. N.W., Washington DC 20036; (202) 682-1984.

2. *U.S. Space Camp*, a nonprofit educational organization, is open to students in grades 4-12, and to educators

who may participate in graduate or in-service teacher training, workshops, and conferences. The main goal of Space Camp is to motivate students to study mathematics, science, and other high-technology subjects. More than 150,000 students have graduated from Space Camp programs since 1982. Space Camp tuition ranges from \$450 to \$750, excluding air fare. Scholarships are available in three categories: scholastic achievement, ethnic background, and financial need. For further information, contact: U.S. Space Camp, U.S. Space and Rocket Center, P.O. Box 070015, Huntsville AL 35807-7015; (800) 63SPACE.

3. The *U.S. Space Foundation* is a nonprofit educational organization promoting public awareness of America's space programs. It serves as a national resource for research and educational information on all aspects of space. The Foundation, in conjunction with the U.S. Air Force Academy, offers a five-day graduate level course, "Getting Comfortable Teaching with Space." Shorter in-service courses are also available in local school districts on request. Members of the Foundation's "Project First Step" designed an innovative middle school science curriculum using astronauts and other scientists as role models. For more information, contact the Foundation at 2860 S. Circle Dr., Suite 2301, Colorado Springs CO 80906-4184; (719) 576-8000.

4. The *Challenger Center for Space Science Education* is an international network of facilities and programs

founded by the families of the seven crew members of *Challenger* flight 51-L to continue the crew's educational mission. Currently, 14 high-tech space simulators are located in science centers, museums, and school districts across the U.S. and Canada. The simulators fly middle school students through two-hour missions where they learn science and develop problem-solving and communication skills. The *Challenger* Center has developed a wide range of student and teacher programs, which are often led by members of NASA's "Teacher in Space Program." The Center also offers live international teleconferences. For further information, contact The *Challenger* Center for Space Science Education, 1055 North Fairfax St., Suite 100, Alexandria VA 22314; (703) 683-9740.

5. The *Astronaut Memorial Foundation* was established in the aftermath of the *Challenger* accident to honor all 16 astronauts who have lost their lives in the line of duty. The Space Mirror National Monument was established at the Kennedy Space Center by a joint resolution of Congress. In addition, the foundation is creating a Center for Space Education on six acres of land adjacent to the memorial to further enhance NASA's education program. The center will also explore and develop new learning techniques and environments for the future. Plans for group and individual activities run the gamut, including: demonstrations, discussions, conferences, workshops, symposiums, and lectures. The center will also provide films, satellite transmissions, and

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A Low Cost, Low Power Pretzel Transmitter, Good Enough to Eat

This month's project started when I decided to clean up my workbench. Seemed I had all kinds of parts laying about on the bench to build a small transmitter (and a color TV, X-ray machine and so on.) So, with pencil in one hand and a broom in the other, I started working on a schematic while the soldering iron cooked on the workbench. This is a project that just begs to be changed and modified. In fact, I'd be upset if no one modified it for their own use. The schematic is shown in Figure 1.

The project began as a transmitter for 18 MHz but, lacking a proper crystal, the transmitter ended up on 10 MHz instead. Also, I built this project on a single piece of double-sided PC board using the *ugly* construction method. If you've never tried this method before, you're in for a surprise. Normally, you use high-value resistors (1 megohm or higher) as tie points for the various connections. I didn't take this route; I used *sky wiring* instead. In sky wiring, the connections between components just tangle in the air. This does make for a few problems, the biggest of which is having the different connections short out against one another. I fixed this problem by using small pieces of pretzel here and there. I always have a fresh supply of pretzel crumbs on my workbench. And no, I have no idea what the capacitance of a length of pretzel is.

You'll also need at least two sizes of soldering irons. A large, 35 watt iron is needed for soldering to the copper foil. The copper foil is a very good heat sink and a smaller iron (15 watts or less) does not have enough oomph to make a good solder joint on the copper foil. You'll still need a smaller iron, though, to make connections between the individual parts.

To keep the cost down to almost nothing, the antenna connection is simply soldered directly to the output filter. Likewise, the crystal is soldered directly to the VXO capacitor, without a socket. Be careful when soldering to the crystal—too much heat and you'll end up destroying it.

The Circuit

A VXO is used for frequency control. They're simple to build and give you an ideal method of frequency control, without the drift of a VFO. The supply voltage to the oscillator is regulated in two different ways. First, a 78L08 regulator provides a stable +8 volts to the collector of the oscillator's transistor. Second, a red LED is used to supply 1.5 volts of bias to the base of the transistor. A red LED makes a cheap and dirty regulator (and there were plenty laying around my bench).

By adding a small amount of inductance in series with the crystal, we can expand the range of the VXO. The value is not especially critical, so don't get overly concerned with the number of turns to use and on what core. Depending on the crystal, the amount of inductance may need to be changed to get proper VXO action.

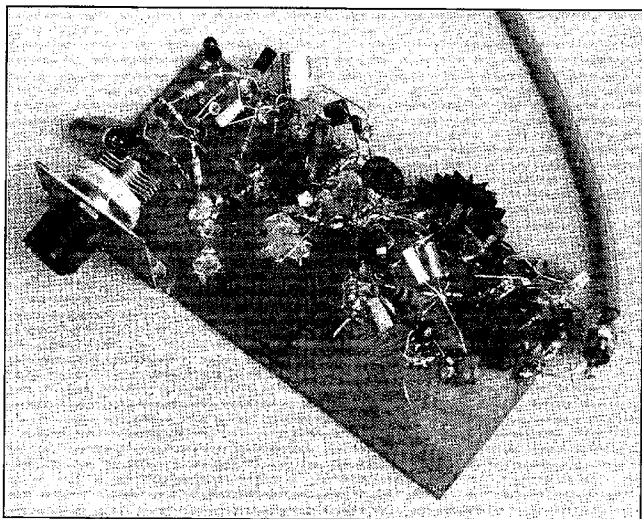


Photo A. The junk box rig on 30 meters. Note the pretzel between the buffer and the driver transistor.

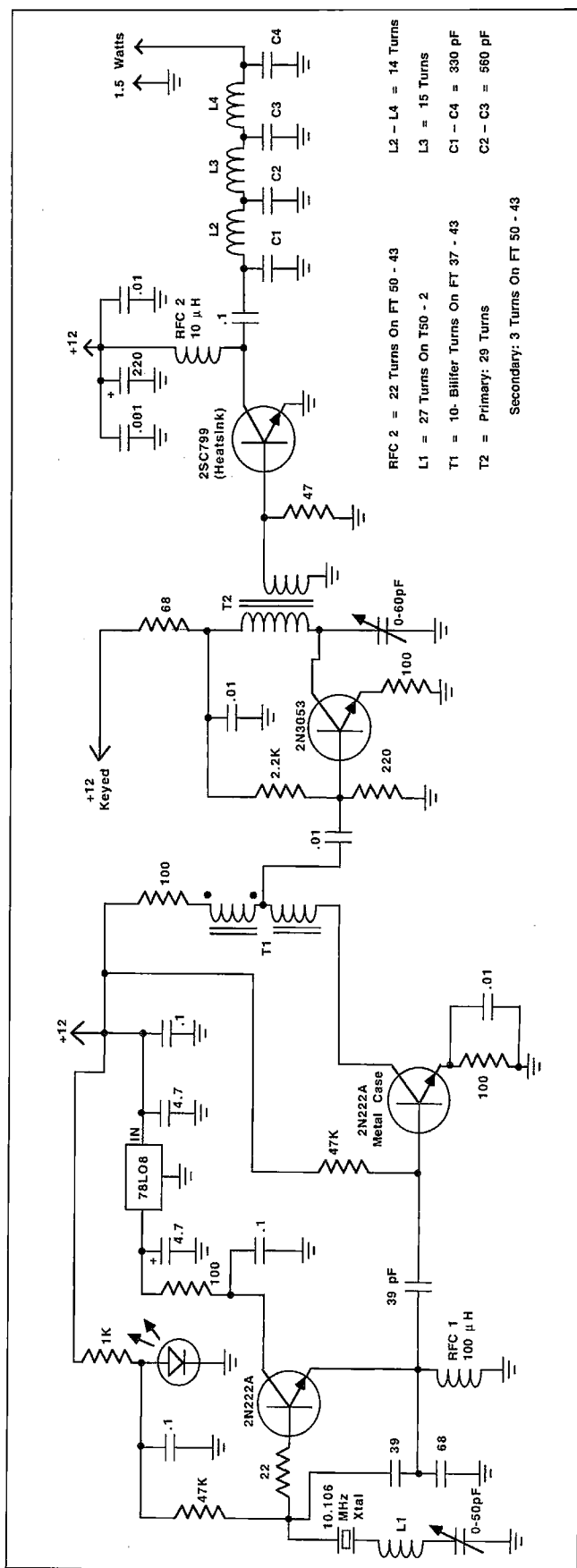


Figure 1. Schematic for the junk box 30 meter pretzel rig.

The main tuning capacitor I have listed as 50 pF on the schematic. In my version, the capacitor I used looks like it may be only 20 or 30 pF. Even with this small value, I'm able to go from 10.115 MHz to 10.122 MHz with a crystal marked 10.116 MHz. That's not too bad, as this range puts me right about in the middle of the action on the 30 meter band. Depending on the value used for your tuning capacitor, crystal and series inductors will determine the frequency swing. Some crystals will bend more than others, giving you greater VXO swings.

The oscillator runs all the time; it is not keyed. The supply voltage of the oscillator must be removed or you'll hear its signal in your receiver. If you plan on using this oscillator for a direct conversion receiver you'll need to keep it running. If you want, a second low-value capacitor may be used to couple some RF into a mixer for your receiver.

Energy from the oscillator is coupled to the buffer via a small capacitor. In my model, I found a 33 pF cap on the bench, so that is what I used. Reducing the value of this capacitor will reduce the amount of RF coupled into the buffer. The smaller the value, the less pulling of the oscillator during keying. To a lesser extent, this will affect the amount of output power, too. Don't go too low or you'll end up with a QRP transmitter. On the other hand, don't use too much capacitance either. It will load down the oscillator and give you no more output at the antenna. Values between 20 and 100 pF should work just fine.

The buffer consists of another 2N2222 transistor. The 2N2222 I used is in the metal-case style. These seem to be a bit harder to kill and I've found you can get a bit more power out of these metal-cased units than the popular plastic jobs. A trans-

former decouples the RF from the collector of the buffer and a small amount is then placed at the base of the driver transistor.

The driver uses a 2N3053 transistor in the TO-5 case. This stage is tuned by the 2-40 pF trimmer on the collector of the driver. The trimmer I used seemed to be a bit too small, so another 37 pF capacitor was soldered in parallel with the trimmer. The driver is the only stage that is keyed. Keying is done by applying +12 volts to the driver. The transmitter keys very well. There are several bypass capacitors on the collector to keep RF out of the VCC line. In most cases a PNP keying transistor would be used here. I could not find one, so I keyed the rig by the "arm-strong" method—I used a clip lead! Figure 2 details a keying transistor and how you would interface it to the project. I did not use a heat sink on this driver transistor, but one wouldn't be a bad idea.

RF from the driver is coupled via the transformer's link turns to the PA transistor. A 47 ohm swamping resistor on the base of the PA transistor

helps stabilize this stage. You'll need to use a heat sink on the PA transistor. The output filter is of a standard design using three toroids. Silver mica capacitors would be my capacitors of choice, but I used ceramic capacitors without any noticeable trouble.

By changing the input impedance of the filter we can get more RF out to the antenna. Normal input impedance is 50 ohms. This was exactly the case in my version. Instead of using the standard value capacitors in the first stage, I changed the input impedance of the filter. I started with 140 pF and, by adding small-value capacitors in parallel, I steadily increased output power. After I got done, I had over 3 watts of clean RF going to the antenna, and a real mess with all those capacitors soldered in parallel! Three watts is about one S-unit over the normal 1.5 watts you'll get. The values shown in the schematic will produce an output power of 1.5 watts. It's up to you to play with the output filter impedance and thus change the output power of the rig.

The transistor used in the PA is

somewhat critical. Because the leads are rather long, it's best not to use a transistor with a lot of gain, especially in the UHF range. That means don't even think about using a 2N3866! I used a junk box version of a 2SC799. A transistor pulled from a junk CB would be a fine choice too.

As I mentioned earlier on, this is a project just begging to be changed and added to. The only points to worry about are the lead lengths on the PA transistor and the driver. Try to keep them as short as possible. This is especially true of the emitter lead of the PA transistor.

Remember, the case of the driver and the PA are connected internally to their collectors. Therefore, they are also connected to the VCC line. Don't allow them to contact the copper foil or you'll end up with fireworks and melted transistor leads.

Have a good time with this project. Even if you don't get it to work, it's great practice in radio theory. If nothing else, find out why something won't work. Learning is always a process of correcting mistakes.

Clear the Pretzels Off the Bench!

One of the reasons I had to clean up my workbench was to start construction of the ARK 40 transceiver. This is really a slick project, especially if you're tired of the usual VXO- or VFO-controlled NE602 transceiver. The ARK 40 will produce a hefty 5 watts output on the 40 meter band. Oh yes, the ARK 40 is a fully synthesized rig on the 40 meter band. It's simple to operate and a joy to use. You can find a complete review of the ARK 40 elsewhere in this issue of 73.

Next month, I'll have some details about computing the values for the output filters. Until then, remember, use wits instead of watts.

73

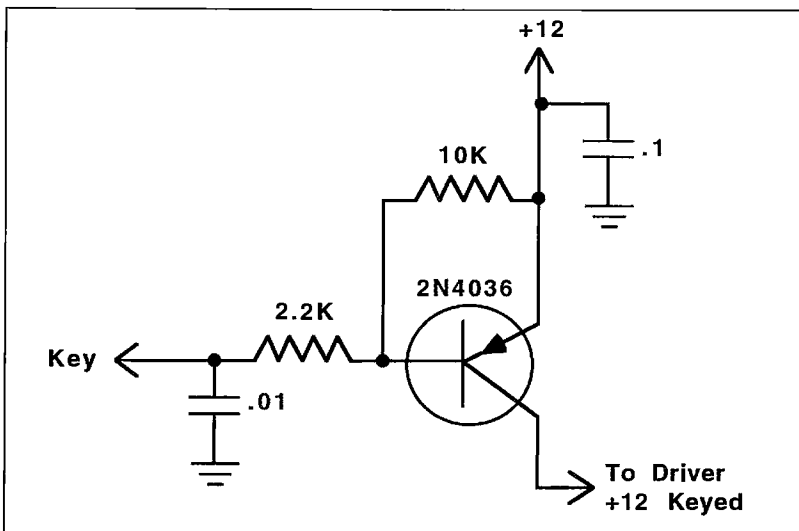


Figure 2. Schematic for an optional keying transistor and how you would interface it to the project.

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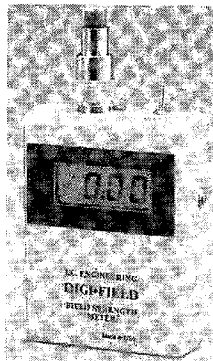
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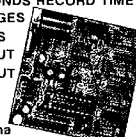


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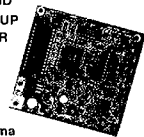
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ATV from Mt. Diablo

Just east of the San Francisco Bay Area lies a majestic mountain called Mt. Diablo that rises over 3,800 feet above the surrounding terrain. From the top of Mt. Diablo you can see most of the Bay Area (Berkeley and parts of the East Bay are shielded), as well as an unobstructed view of the Sacramento Valley. On a clear day you can see the snow-capped peaks of the Sierra Nevada range over 100 miles to the east stretching from north of Sacramento nearly down to Fresno. Mt. Diablo would seem to be the ideal site for an ATV repeater.

Don Smith W6NKF certainly thought so! In 1981 he installed his ATV repeater on a site near the top of the mountain. Don's system was a bit unusual since the Bay Area has a unique problem. It turns out that there is a military base near Sacramento that operates an over-the-horizon radar system called Pave Paws. This radar transmits megawatt pulses in the 420-450 MHz range that blanket the Bay Area, particularly the top of Mt. Diablo. Since any input in the 400 MHz band would be constantly wiped out by the radar, Don chose to put the input on the 1200 MHz band with the output on 427.25 MHz. He even worked out an agreement with the Pave Paws operators to keep the 427.25 MHz frequency clear from the radar signals. The repeater's output corresponds exactly with cable-ready channel 58 and allowed many folks to

view the repeater using just a simple antenna and cable-ready VCR or TV set.

The W6CX ATV Repeater

Currently owned and operated by the Mount Diablo Amateur Radio Club, the Mt. Diablo ATV repeater has an input on 1253.25 MHz AM with an output on 427.25 MHz (both vertically polarized). The repeater's antennas are mounted near the top of a 190-foot tower near the mountain peak and provide a 360-degree view of the region. With a range of over 100 miles, the repeater covers most of the San Francisco Bay Area, as well as the Sacramento Valley from north of Sacramento to south of Stockton and into the foothills of the Sierras. There are around 40 active members on the air (and many more who monitor the repeater via cable-ready VCRs). Two of the members reliably access the repeater from over 90 miles away. Occasionally the Black Mountain group will retransmit the Mt. Diablo output through their repeater in the San Jose area so that those in the East Bay can view the activities.

Every Thursday evening at 8 p.m. Pacific time, an ATV net is held on the 147.06 repeater and usually generates a lot of activity. This repeater and the 224.78 repeater are generally used for the ATV talk frequency in the region.

PACIFICON'93

Sponsored by the Mt. Diablo ARC, this year's PACIFICON convention (held October 22-24 at the Concord Hilton hotel) will again feature a live ATV demonstration console (see the photo). The ATV group plans to cover



Photo A. Jim Tittle KC6SOE mans the ATV control console during PACIFICON'92.

featured speakers, special events and highlights of the convention through the use of multiple cameras, videotape and remote feeds. This footage can be seen on the hotel's in-house cable system and will be transmitted through the ATV repeater as well.

One highlight this year will be an ATV balloon launch. Bill Brown WB8ELK and Don Smith W6NKF will be sending up the balloon between 10 a.m. and 11 a.m. on Saturday from the Concord Airport (Buchanan Field), just one mile from the convention. The balloon will feature a live TV camera transmission on 434 MHz, with on-screen telemetry overlay. An on-board GPS receiver will relay the balloon's position to aid in tracking and recovery. In addition, a simplex repeater will operate on 2m (144.34 MHz) and a beacon can be heard on 28.322 MHz. At the peak altitude of 110,000 feet, anyone within 400 miles of the Bay Area should be able to see the balloon's video and work through the re-

peater.

The chase team T-hunt group will be led by Syd Furman W6QWK and anyone with DF gear is invited to join in the chase effort. If all goes well with the Saturday launch, a second flight is tentatively planned for Sunday morning as well.

The Future

A 1200 MHz output for the Mt. Diablo ATV repeater is in the works (in addition to the 427.25 MHz output). Also, plans are being made to eventually establish a microwave linkup with Southern California.

If you'd like to see what's going on in the North Bay area, just drop on by for the Thursday night net and watch the action. With over 50 watts output power (soon to be 100 watts), you should be able to see the repeater with modest equipment (cable-ready VCR/TV and just about any outside antenna) as long as you're line-of-sight to the mountain.

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10 GHz SSB QRP Transceiver

This month I thought I would describe a 10 GHz SSB QRP rig in its simplest form, then later show you how to modify it into a very formidable station. The improvements to the basic SSB converter can be added easily to make it buildable from the components you have. By following the basic layout you should be able to duplicate this rig at various stages of evolution—from the very basic to the more complex 10 GHz SSB station. The IF frequency used in each case is 2 meters.

This design process might look a little awkward but be assured, this rig is quite formidable in operation. Last month we discussed some of the reasons why reduced bandwidth systems are high performers. This month we will discuss this basic 10 GHz SSB system, which delivers high performance yet is constructed from minimum components. Then with this same basic circuit you can add components as you find them. I will attempt to describe several modifications or steps that will guide you in modifying the original unit shown in Photo A. Don't be afraid to make changes—what you build really depends on what you want to spend. The different levels of complexity are offered in an attempt to vary the design to suit your needs.

The main ingredients needed to construct a 10 GHz system include a local oscillator, a Frequency West brick-type amplifier, and the mixer (an orthogonal waveguide-type unit). The RF port of the mixer is connected to a 10 GHz antenna and, with a 2 meter transceiver set to low power, is connected to the IF port. This simple setup will be capable of making narrowband contacts on 10 GHz. See Figure 1 and Photo A, both showing an operating simple system for 10 GHz. This setup will work quite well and is capable of making either narrowband FM or SSB contacts. This, of course, is dependent on the type of 2 meter rig you use for the IF transceiver. My rigs are an ICOM 202, and a Santec LS-202A multimode HT. Both rigs were used. They're both older radios but, they perform quite well. The Santec has been my main radio for SSB operation.

The design of this system is what I prefer to call a "COAXIAL" based system, differing from a "WAVEGUIDE" based system, such as in wideband FM. Components can be added to this system as desired to improve its capa-

bilities. Each component added to the system can increase its complexity and cost. However, each has specific attributes giving system performance improvements that far offset the costs involved. The first improvement to be considered is the RF preamplifier and associated coaxial switch that is needed for a dual role for the amplifier. More on that later.

The preamplifier that we use is a dual-stage amplifier using two MGF-1402 FETs. The amplifier PC board for this amplifier is 3/4" by 1" and constructed on 0.031 Teflon PC board. Figure 2 shows a schematic for this preamp. The source leads are connected to ground on the board with a very short lead length (actually no lead) and upside down. With the case inserted in the hole cut in the PC board (with the FET upside down), the ground foil is soldered directly to this gold metalization of the case, making for almost zero lead length. This is the biggest secret in construction of this PC board amplifier: zero lead length of the source lead, making for minimum inductance in the source path to ground. Please note that some designs require some inductance in the source leads; however, this design does not.

At lower frequencies, FETs give increased gain, and this further increases as frequency is reduced. FETs that have an Ft (frequency total) of 80 GHz or so become unstable at very low frequencies. That's why some source inductance is necessary at low frequencies to help make the design stable. At high microwave frequencies this is undesirable and will make a design function better as an attenuator than as an amplifier. The thing to remember is that the extreme towards minimum is necessary at upper microwave frequencies.

The rest of the construction is basic in that good microwave components

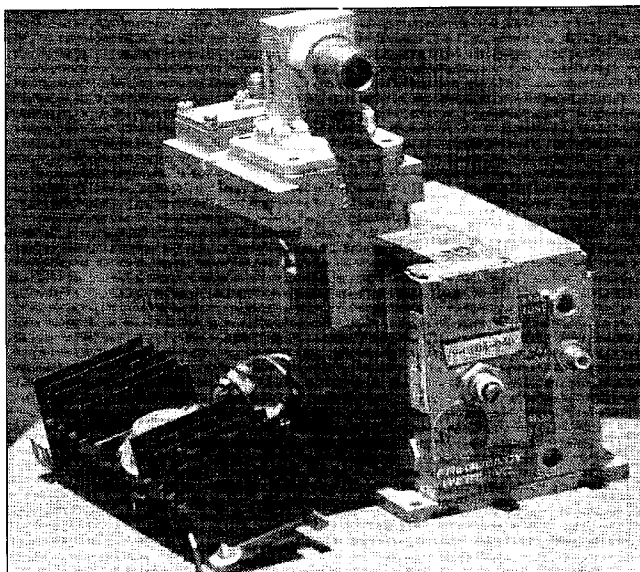


Photo A. A 10 GHz QRP rig. A 20 volt regulator is located on the black heat sink.

are necessary for low loss. That mandates that chip resistors and chip ceramic capacitors be used in the preamplifier. If you wish to design your own amplifier, a program called PUFF is available from CALTECH that will allow you to design your own custom PC board with the FET of your choice.

"Above and Beyond" for May and June 1992 covered PUFF and its applications.

Take, for example, an amplifier which was designed using PUFF with an NEC-04583 FET. This circuit or others could be used in place of the dual-stage amplifier described earlier. Both

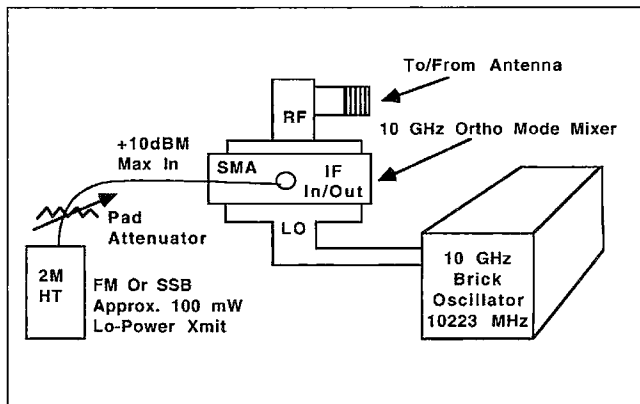


Figure 1. A 10 GHz QRP rig suitable for narrowband FM or SSB.

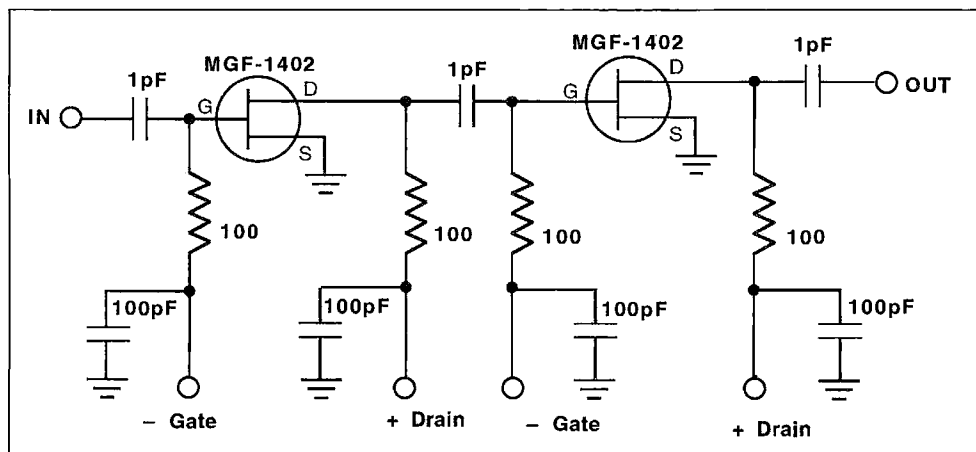


Figure 2. A 10 GHz RF amplifier with 18 dB gain and approximately 2 dB NF. It is capable of +5 dBm output when used as a transmit amplifier.

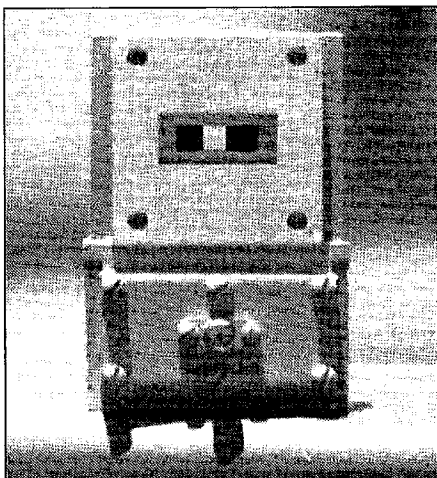


Photo B. A 10 GHz ortho mode mixer. Looking through the mixer waveguide port you can see rear port 90 degrees offset. The SMA connector is the IF port.

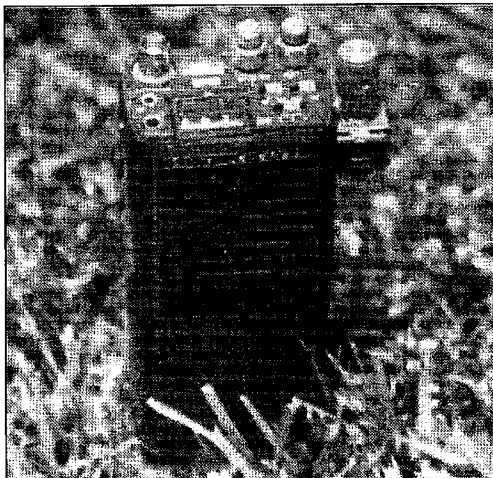


Photo D. My trusty Santec LS-202A 2 meter FM/SSB HT.

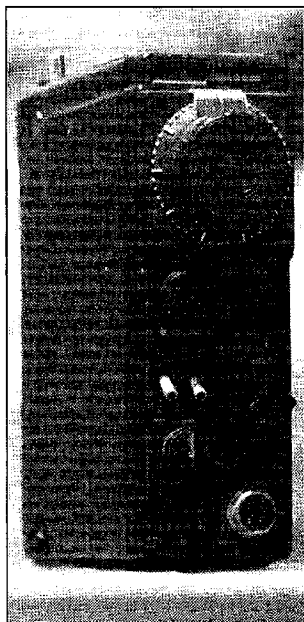


Photo C. My ICOM-202 SSB 2 meter pre-hand-held radio.

designs require a simple bias supply to function. It can be as simple as a "double A" (AA) flashlight cell connected up to supply negative gate bias current. An additional positive regulator is required as well, for the drain supply. Normally this voltage is near +4 volts. We have built both simple supplies and ones that use ICs to generate the negative voltage. Either will work well.

The bias (negative) is adjusted to give the required drain current for your FET. This can be adjusted for a minimum noise figure or increased for higher current for slightly more power output. Check your FET's specification sheet for exact current requirements. For the MGF 1402 FETs we adjust the first low-noise stage (between 10 and 15 mA) for minimum noise. The second stage is set (to 20 mA) for best gain. Next comes the relay switching. We could live without them and dedicate the amplifier for either receive or transmit. But, in this case I decided to use the same amp for receive and transmit and switch it with relays.

The relay used at 10 GHz must be rated for 10 GHz operation. As such,

the circuitry internal to the coaxial switch resembles a transmission line, providing for low losses at microwave frequencies. Two types of relays can be used: the SPDT (single-pole double-throw) type, or the transfer type. Several SPDT relays would have to be used but only one transfer relay is needed to work in the simplest configuration. I have used each method and they both work well.

For simplicity, the transfer relay is the easiest to use, that is if you can locate one. It is most suitable as only one relay is required, allowing the preamplifier to be used for both receive and transmit amplification. You can usually tell a transfer relay from its standard counterpart by the *four* coaxial connectors on the transfer relay, versus three for a standard SPDT type coaxial relay.

Let's look into the construction of each and see what is going on. In the SPDT type (miniature SMA type relay) there are two sets of contacts, as shown in Figure 4. This relay can best be described as having balanced pole operation, like a teeter-totter. One section makes contact with half of the

common center pin and the other contact (let's call it normally closed). The other section is off balance or down to ground making no contact to any coaxial connector, maximum isolation. When the relay is energized, the normally closed contact toggles and becomes the one that is now grounded or off-balanced and the other section (the normally open contact) is now making connection between the other half of the center contact and the normally open contact. SPDT operation.

The operation in a transfer relay is quite different in some respects in that it has four (coaxial connector) contacts. It has a modification of the teeter-totter operation in that there are four contact bars while the SPDT type has two. The toggle operation occurs between two of these bars diagonally positioned inside the relay. What happens is that the relay makes contact along the top and bottom of the relay, leaving the side bars in the open position. When the relay is activated the top and bottom release their connections and the left and right side bars make connection. See Figure 5 for details on the transfer relay and its schematic switching application.

With either relay system in place, switching an amplifier from receive and transmit is quite easy. It can become complex if and when we add additional components into this switching loop. For a basic SSB unit with switching, this is all you need for an operational SSB 10 GHz narrowband system using 2 meters as an IF. Drive

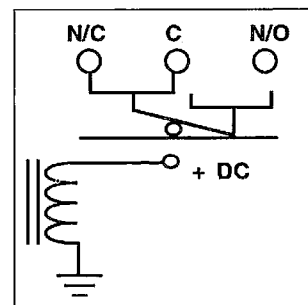


Figure 4. A SPDT relay.

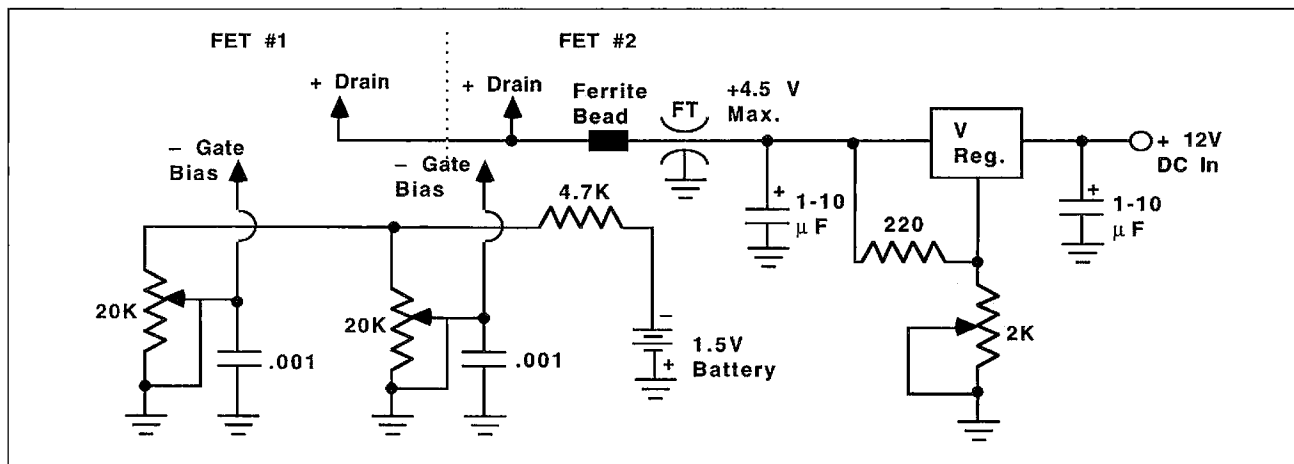


Figure 3. A DC bias supply for the 10 GHz amplifier. The battery should last for a couple of months.

power should be held to +10 dBm maximum to the mixer.

This system, with a 10 GHz FET amplifier (home-brew), can boost output power on transmit to somewhere near the +5 to +8 dBm power level. That's a power output of 4 mW to 7 mW (0.007W). Don't scoff at that power as it is quite capable of driving other higher-power amplifiers, such as traveling wave tubes, to full power of 10 watts or more. These do not need to be added now but can be as time and money allow. The simpler low power rig will work quite well with the lower power level. Additional gain can be quickly realized through passive antenna gains.

Realize that 0.007 watts is real QRP power and can give exceptional operation using SSB. Comparing operation on 10 GHz QRP levels and system gains in respect to lower frequencies such as 2 meters, you can draw comparisons by noting that with lower frequencies antenna gain is markedly reduced. A 30" dish antenna on 10 GHz can exhibit 35 dB gain, making for quite a punch, even when using a QRP rig. That's a lot of gain advantage even when compared to a good 2 meter antenna which can run in the 10 to 15 dB range. You would have quite an antenna farm at 2 meters for similar gain as this small dish at 10 GHz.

That's one factor which makes QRP levels workable with reduced bandwidth SSB microwave operation: very high antenna gain and very low power systems. Comparing even further: At 24 GHz the same approach is used, making more power gain in the antenna than is usually in the amplifier at this level. Most rigs today for 24 GHz are limited to very low QRP levels; that is, before antenna gains. This passive antenna gain is what gives microwave low power level rigs quite a boost in radiated power. This gain in power is the most inexpensive to accomplish in short order. The bad news, at least on 24 GHz, is that the equipment is difficult to obtain even in the land of plenty here in California. If there is inexpensive equipment for 24 GHz then it should be advertised because it would sell.

So much for QRP antennas. The main point is that at a very low QRP level, stations at microwave frequencies are still very effective. The 10 GHz QRP station described above, with or without the preamplifier, is an effective system. Don't let yourself be locked into the design that I presented in the example given. The local oscillator does not have to be a waveguide type of system to mate with an orthogonal type of waveguide mixer. In this case use a waveguide to coaxial transition to accomplish the connection in and out of the mixer. There are many different methods that you can use to make adjustments in system construction and still have a great rig.

Mailbox

Steve Roberts N8VKD of Suffield, Ohio, is looking for others in the Ohio

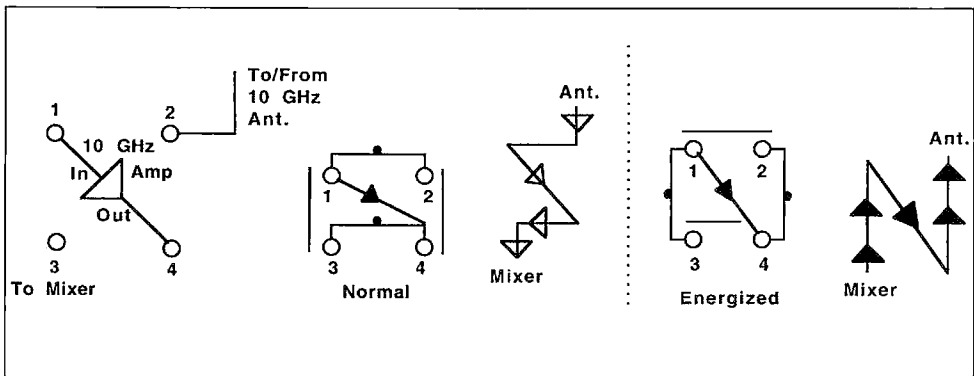


Figure 5. This four-contact transfer relay effectively reverses the amplifier. It is wired with the amplifier in to terminal 1; amplifier out to terminal 4; antenna to terminal 2; mixer out to terminal 3. Normal (not energized) state: contacts 1—2 & 3—4 closed. When energized, the relay opens 1—2 & 3—4 and 1—3 & 2—4 connect.

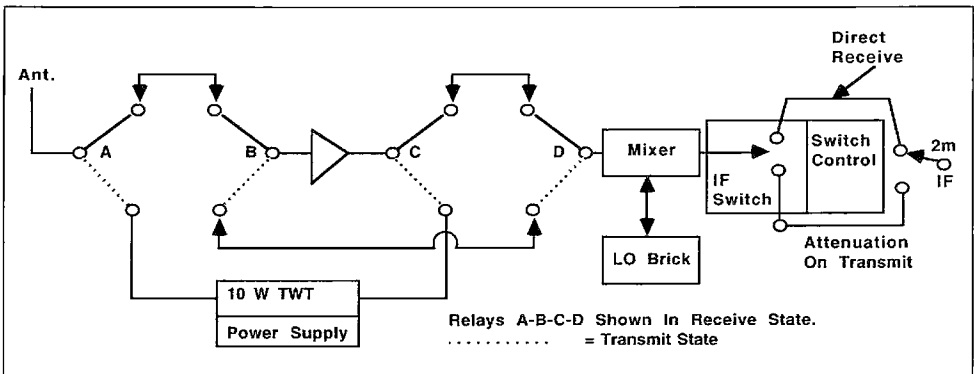


Figure 6. Full implementation of switching with 4 SPDT coax relays, switchable preamp, and 10 watt high power TWT amplifier.

area who are interested in 1.2 GHz and above. He remarked that "if you asked for a Gunn you might get a response like 0.22 or 0.45 caliber." Well, the same mystique abounds here in California. I have difficulty with the knowledge gap, so when you get on to discussing the electron effect in Gunn devices being negative resistance . . . well, you can just imagine the eyes glassing over. It's a hard hill to hoe without some moral support, especially when you know that you are well-founded in scientific fact. Trying to convince someone that negative resistance is a true phenomenon is about as easy as teaching a pig to sing. What we did here was to set up a sign and an operating 10 GHz simple wide-band two-way system at our local ham swap meets and we were able to get quite a response to our pleadings. Later we formed the San Diego Microwave Group.

I think all that is needed is a little prodding and a lot of advertising, similar to the methods we used. Club meetings and such are a good example and I am sure most are looking for a good program to provide for their members. Sure, you won't interest all the members attending, but a good well-rounded information session on your part of the frequency spectrum as it applies to amateur radio in general can come off well.

Raymond N6RE writes that ever

since I published the material on converting the 3.7 GHz LNA amplifiers he has been looking for some to modify. Could we steer him in the right direction? Well, I can only offer some likely sources for you to try. The first is the newspaper—look in the classified ads for satellite antenna installers and also in the Yellow Pages under satellite and TV shops. I made several calls to local shops and most wanted to sell me brand-new units. In bigger shops try to get by the salesman and talk to the repair technician. When I was able to do that I was able to line up some prospects that might prove interesting. One call to a local high profile installer was met with the initial "sell, sell," but when he found out that I wanted older units for amateur applications and not satellite use, he stated that he was licensed also.

I have yet to visit him, and don't expect to be given a box full of units. But, rather, I have found out that for a reasonable (small) dollar amount he would be willing to part with some used units. The price discussed was less than \$15 each, but somewhat higher than the \$5 or so I was accustomed to paying at swap meets. However, his units seemed to be a better bet, as the swap meet prices do not include a guarantee of any kind. It just goes to show that you have to go beyond the normal scrounging attempts and get behind the screens of most

bigger companies and talk to the people doing the work to locate parts. Give it a try.

Richard KBØMR of Aberdeen, South Dakota, writes: "Where can I buy a TWT amplifier similar to the ones you described in the July 1993 issue of 73 Amateur Radio Today?" Well, Richard, they're not the easiest to locate and when amateurs have found them they were not always careful to get matching power supplies and tubes with them. That's the main reason I wrote the article—to inform our readers about what is available in surplus. From time to time I have a spare unit and they have sold for less than \$200 for a working unit. I feel that the price in some surplus outlets is far too high and they don't even guarantee that they will function. I guess they're looking for a customer who is willing to pay the high price for exactly what he wants.

At this moment, I don't have a source for these materials. Components used to come out of Surplus Sales for Collins Electronics in Richardson, Texas. If I locate a source I'll print it; if anyone knows of one please drop me a line.

Well, that's it for this month. As always, I will be glad to answer questions concerning microwave and other amateur related topics. Please send an S.A.S.E. for a quick response.

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More Mobile Operation

Last time, we were discussing mobile ham radio installation and operation. Let's continue.

The Real Thing

OK, you got a few bucks together or you got lucky at a hamfest, and you bought yourself a real mobile rig. What can you expect? Well, it sure will work a whole lot better than an HTI. Now you've got anywhere from 10 to 50 watts of power, tremendously greater audio output and, hopefully, a tougher receiver.

Installing a mobile rig is pretty easy, but there are a few things to consider. First of all, you need good, clean DC power at anywhere from 5 to 15 amps. As I mentioned last time, there is no such thing as clean power in a car; it's always loaded with junk. Luckily, mobile rigs, being designed for car use, take that into account and usually have their own internal power filters. Here's a good way to tell: If you have alternator whine, either in transmit or receive, you need an external filter. If not, then

don't worry about it.

If your rig puts out 10 or 15 watts, your power requirements probably aren't that heavy. Most likely, you don't need more than 5 amps. You should be able to get that from the fusebox. A good place to tap in is on the fused side of the line powering your car stereo. Heck, you're not going to be blasting it at high volume and transmitting at the same time, so you're not likely to blow the fuse. And even if you do, there's no big harm done. Just be sure to connect up to the correct side. *Never* run any radio gear (or anything else, for that matter) from an unfused line. The damage you can do to your car just isn't worth it. Of course, if your rig's power cord has its own fuse, then you can hook it up wherever you want. Just keep in mind that any short before the fuse can still cause trouble. In particular, run the wires so that they won't be crimped by the car's brackets or other body parts.

If you have a high-power rig which puts out, say, 40 or 50 watts, you're gonna need some real juice to run it. At 50 watts output, you may need up to 15 amps, and that ain't peanuts, especially because your rig is FM and runs that power *continuously* while you transmit, unlike an SSB HF rig, which only de-

mands high current on voice peaks.

Getting that much current through your car's electrical wiring is asking for trouble. The preferred method is to go directly to the car battery, but that can be tricky. Your car battery can deliver hundreds of amps on demand, and that kind of current is dangerous. Shorting a car battery even for a moment will cause serious sparks and possibly melt the wiring or the battery. The battery may even explode as its internal gasses quickly build up under the heat of its chemical reaction. You can be disfigured, blinded or even killed by an exploding car battery, so please, please play it safe.

How?

First of all, get approved high-current wiring from an autosound or auto parts dealer. Whatever you do, *don't* use coax cable as DC power wiring. Yes, it's shielded and seems to work well, but it is not designed for high DC current, nor is it meant for the temperatures under the hood of a car. The result is that, over time, the inner conductor's plastic jacket will deform and eventually melt through, causing precisely the kind of disastrous short I just discussed above. The risk of an underhood, car-destroying fire is large.

Whatever kind of wire you use, it must be rated to carry the intended current. Also, you must fuse it right at the battery so that shorts anywhere down the line will not cause a disaster. Another fuse right at the radio is a good idea, but that alone will not pro-

tect you if, say, the wire shorts at the firewall or comes in contact with the engine or radiator and melts.

When connecting things to the car battery, be sure to disconnect the battery's negative terminal first so that there can be no return circuit through the car body. That simple precaution can prevent serious injury. Remember, there's enough current there to take your finger off, should it inadvertently connect through a ring you're wearing. It has happened.

Ground?

Obviously, there's no real "ground" on a moving car. But to the circuit, ground is the car body and chassis. Where do you hook the negative lead up? Well, for low-current radios, just about any metal screw in the passenger compartment will do. To check for suitability, use an ohmmeter to be sure the screw is, indeed, connected to the chassis. Especially on late-model cars, many screws are set in plastic, which, obviously, won't do.

In high-current applications, it is best to ground the negative lead to a large screw in the engine compartment, somewhere fairly near the battery. Check the spot where the battery itself connects to ground; what could be better?

Where Does It Go?

In today's small cars, it can be hard to find a good place for your rig. Look for a spot where you can easily operate the controls without interference to your driving. Also, the mike cord has to

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reach your mouth without getting tangled in the steering wheel or gearshift lever. And you have to have unobstructed access to the foot pedals. Finally, make sure you don't mount the rig where you will smash into it with a knee or other body part in the event of an accident. If you just can't find such a location, consider buying one of the new rigs which lets you separate the control head from the rest of the radio. The small heads fit just about anywhere.

The Skyhook

Many hams use magnetic-mount antennas because they're easy to remove and hide, and they don't require any installation. They work well, but they do have a tendency to scratch the car's paint. When you put the antenna on, be sure to wipe the mount's bottom off first, because the powerful magnet often picks up little metallic bits and those can really eat your paint away. When the antenna is in the car, be sure to put it somewhere where it can't be seen, and also consider how close you are putting that giant magnet to your stereo, recorded tapes, the rig and other equipment. I keep mine in the back, away from everything.

The coax cable usually exits through the door seal, a window or perhaps the trunk or hatch. The main considerations are that the cable doesn't get crimped (which could result in a transmitter-damaging short) and that rain doesn't get into the car at the entry point. Luckily, most cars have big

enough rubber seals that these problems don't occur.

For permanently mounted antennas, just follow the manufacturer's directions. If you're going with a permanent roof mount, it may be best to let a professional shop do the drilling and mounting. I tried it myself once, and it was very difficult to drill through the roof. Mine eventually worked out fine, but it is possible to have serious leakage problems which result in rust damage.

The Ultimate

Mobile VHF/UHF is plenty of fun, but nothing compares with talking around the world on HF while tooling down the highway. Installing a mobile HF setup is much like installing a high-power VHF/UHF rig, but there are a few extra considerations.

You will need lots of current. Assuming the standard 100 watt rig, figure on 20 amps. Some HF rigs are very tolerant of varying voltage, while others tend to "FM" and pull off frequency or experience other problems if the voltage swings as you talk. So, be sure to use extra-heavy DC wiring and go directly to the battery; forget connecting to the fusebox. All the same guidelines for high-power installation I discussed above apply. With SSB, AM or CW, though, your receiver is amplitude-sensitive, and engine and alternator noise problems will be much worse. You can buy shielded high-current power wiring, and it's probably a good idea. But again, *don't* use coax, no

matter how tempting it may seem. Your rig won't be much use to you if the car burns up.

There are various kinds of mobile HF antennas, but most are designed for bumper mounting. I have had the best results with a standard bumper mount, a whip spring and a guy string. I keep the string tied to the back of my seat and run it out the hatch window to hold the antenna in place. If you have a trunk, you can run it out the top of the trunk after tying it to an internal support.

Running the antenna coax can be a problem. Look at the bottom of your trunk or under your hatch area and you probably will find a few rubber plugs. You should be able to remove one and run the cable through the hole. Be absolutely sure to use some silicone sealer to plug the hole back up, though, or you will have leakage problems. When routing the cable underneath the car, keep it away from the muffler, exhaust pipes and gas tank. Finally, be sure to ground the antenna mount to the car and use some coax sealer to weatherproof the connection. Don't expect to do an HF installation in an hour or two. Usually it takes an entire afternoon.

Well, there's a little more to cover, but I'm running out of room. Before we go, let's look at a letter:

Dear Kaboom,

I'm a 22-year-old sailor in the U.S. Navy. I've enjoyed listening to HF DX since I was 12 years old and hope to

soon have my General Class ham license. I've never really known any ham operators and have lots of questions regarding operating practices, RTTY, packet and such. Is there anybody you could steer me to to get my feet wet? Also, could you tell me which products I should buy to set up a station?

Signed,
Ready To Go

Dear Ready,

I see that you are stationed in Japan. You are lucky to be in the highest per capita ham population in the world. There are over a million hams there and plenty of clubs. Also, they have some serious ham magazines. Unfortunately, you will need to speak Japanese! Lots of U.S. ships have ham facilities because many of the radio operators are hams. Have you checked this out? Perhaps the help you need is right there on the ship! If not, consider getting an English-speaking Japanese friend to show you around or take you to a club meeting. Finally, keep reading 73! As for product recommendations, I'm not in a position to do that. Most of the companies make good gear and the choice is really up to you. The best thing you can do is get your license and get on the air. Once you do, you'll find more opinions and advice than you ever wanted. I hope to hear you on the HF bands!

Until next time, safe and happy mobile from KB1UM.

73

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Notes from FN42

More good stuff for this month including, the FAIRS trip to Bangladesh (S21-land) to train more amateurs there, and a report from Mike Shakhov UA9MI on the DXpedition to Bering Island in 1992.

I am also very happy to report that Lorenzo Gaston DU1CHD/6 has volunteered to become the Ambassador to the Philippines. He enclosed several great articles, but there was not enough room in this issue to print any of them, so look forward to one of them next month.

Since space was a bit short last month, let me be brief so more info can make it across the press. 73, Arnie N1BAC.

Roundup

Bangladesh FAIRS Bangladesh
Trip Report: An international group of FAIRS (Foundation for Amateur

International Radio Service, Inc.) members planned an amateur radio training program in Dhaka, Bangladesh, during early 1993. The training was to help develop a group of amateur radio operators that could lead to the development of a disaster preparedness amateur radio network in Bangladesh. A DXpedition to help provide training by actual amateur operation was planned. The DXpedition operators hoped to make thousands of radio contacts worldwide. These contacts would give great visibility and support for amateur radio and FAIRS in Bangladesh.

The results of two years of planning and almost three weeks on location in Bangladesh exceeded our most optimistic goals. The international team of three Americans (one American traveled from Taiwan), two Ukrainians, and three Russians arrived on schedule with over half a ton of training and radio equipment. A five-day training program in amateur radio for 30 Bangladeshies was

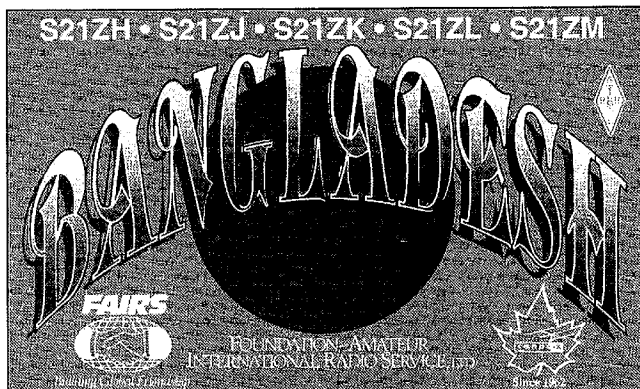


Photo A. QSL of the FAIRS team in Bangladesh.

well-attended. A total of 17 of the 30 participants passed the USA amateur license examinations, which showed there were some highly motivated individuals interested in becoming radio amateur operators. Training for government personnel was provided by Mr. Richard Baldwin, the president of the International Amateur Radio Union (IARU). Mr. Baldwin presented a five-day workshop to about 12 staff members of the Bangladesh Telephone and Telegraph Board (BTTB). His workshop included: the history of ama-

teur and commercial radio, development of international regulations, why amateur radio is good for a country and its citizens, how to develop regulations for governing the use of amateur radio and how to develop amateur radio license procedures. Mr. Baldwin's workshop was independent from FAIRS; however, it was coordinated by FAIRS, the ARRL, and the IARU.

These two training programs made a very significant and positive effect on the interest and awareness of amateur radio in the government,

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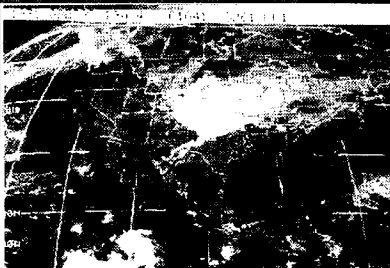
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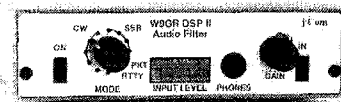
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After covering the distance of nearly 4,000 miles with baggage weighing about 2,000 pounds, we reached Bering Island, a Pacific Ocean island which has a land area of about 600 square miles. It's coordinates are 55 N. and 166 E., IOTA nr AS-39. The expedition was organized by the Western Siberia DX Club with support from the Russian Geographic magazine "Vitus". The radio shack was situated 100 yards from the ocean shore in a little house which was kindly placed at our disposal by the island meteorological station. Having started to operate, we expected to have a great time for ten days. But then something terrible happened...

Photo B. QSL of the DXpedition to Bering Island.

N.G.O., and private sector.

The FAIRS team was fortunate to meet with many officials of the government ministry for telephone and telecommunications in favorable discussions supporting amateur radio. Five Bangladesh amateur radio licenses were issued to our team by BTB. More than 25,000 radio contacts with amateurs worldwide were made with the three radio stations brought from the USA, Ukraine, and Russia. The FAIRS radio DXpedition was a tremendous success and as a result thousands of radio amateurs

and others around the world will be aware of the new interest in amateur radio in Bangladesh.

The international FAIRS team included: David Larsen KK4WW/UB5WUS/S21ZJ, Executive Director, FAIRS; Gaynell Larsen KD4GMV/UB5WMV/S21ZH, Vice Director, FAIRS; Victor Goncharky UB5WE/KC1VF/S21ZM, FAIRS European Operations Director; Helen Goncharky RB5WA/KB0KNC/S21ZM (2nd op), FAIRS Europe Secretary; Yuri Katyutin UA4LCQ/KD4STR/S21ZL, Director of Opera-

tions, FAIRS Russia; Larry Vogt BV/N4VA/S21ZK, FAIRS Training Director, ITU Region 3; Serge Tarasov UA4LLQ/KD4QAU/S21ZL (2nd op), FAIRS member Russia; and Vyacheslav Sergeev, CIS Team Sponsor.

For further information about this trip, future trips, or about FAIRS, contact David Larsen, Executive Director, FAIRS, PO Box 341, Floyd VA 24091, USA; (703) 231-6478; (703) 382-9099; Fax: (703) 382-2935; Internet: david.larsen@fairs.org.

[There was much more of their report, but space was not available to print it all.—Arnie]

Russia HELLO FROM BERING ISLAND! From August 25 to September 7, 1992, four members of the West Siberian DX Club operated a station located on Bering Island, coordinates 55 North and 166 East, IOTA AS-39. The expedition was organized with some support and direct participation of the Russian geographic magazine *Vitus*.

The expedition was devoted to the 250th anniversary of the discovery of the Commodore Islands by Russian explorers under the leadership of Captain Vitus Bering. The radio DXpedition was comprised of

four radio amateurs from the city of Omsk, oblast 146: Valery Matushin UA9NN, chief of the WSDXC; Alexander Ernst UA9MR; Igor Suprunov UA9MFW; and Mike Shakirov UA9MI.

After traveling a distance of 4,000 miles with about 500 kg. of baggage, we reached the Pacific Ocean island of Bering. The island is about 600 square miles of land area and has a population of 1,500 people. Our license gave us permission to operate as 4K4NN and 4K4West Siberia. We were going to operate with the latter call in the All Asian Contest.

The radio shack was situated 100 yards from the shoreline on the first floor of a small house which was kindly placed at our disposal by the island meteorological station. Our equipment included Yaesu FT757GX and ICOM 701 transceivers, a 1 kW amplifier, and an MFJ-949D tuner. Due to a good choice of a clearing with green grass, and the sunny weather, we quickly put up the antennas, a three-element yagi on the 15 and 20 meter bands, a full-size ground plane on 40 meters, and a longwire for the other bands.

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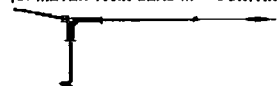


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and Japan and some good openings to the South Pacific. The propagation to Europe was fair in the morning and evening. Most signals to all locations were only about S3 to S5! The best propagation was at the end of August, but beginning in September the propagation abruptly deteriorated. Unfortunately, we failed to operate on the 10 and 12 meter bands while propagation was good in August. During that time, we worked on the 30, 40, and 80 meter bands.

On the 5th of September, hurricane force winds hit the island! The winds gusted up to 80 miles per hour, and the temperature dropped to 0 degrees C, or about 30 degrees F. The wind raged for two days and destroyed all of our antennas and our plans for future operations! Luckily, the building where our shack was located did not suffer any damage.

It must be said that the author of these lines, as well as the other members of the DXpedition, were shocked with the rage of the hurricane. It was the first time that we had witnessed this natural phenomenon. Because of the hurricane, we were not able to carry out our plans to take part in the All Asian Contest or launch a balloon with a longwire for the 160 meter band. We had also planned to operate from Medny Island (Cooper), a smaller island in this group.

On Tuesday, the 8th of September, we left our troubles and the debris of our antennas on the island and flew in a small airplane back to the continent. It took us 48 hours to

get back to our homes in Omsk, Russia.

We made over 10,000 QSOs during the DXpedition, with 140 DXCC countries on SSB and CW, including the WARC bands. The following totals will tell the story: 80m—504; 40m—2061; 30m—463; 20m 5063; 17m—431; and 15m—1557.

In conclusion, we wish to thank all of the hams who worked us, and we are especially obliged to our QSL managers, Ken KC4UG and Walter DK8FS for spiritual and material support. We also want to thank MFJ Enterprises in Mississippi for the 1278 multimode controllers, which helped us to make plans for the DXpedition.

[Many thanks to Ken Carpenter KC4UG, PO Box 586, Vernon AL 35592, for this report from Mike and group. Ken reports that he has operated Mike's home station in Omsk and it is awesome, consisting of a TS-400, 2 kW amp, and seven elements on 15 and five elements on 20 meters. The antennas are on a tower on his 10-story apartment building. Ken would be glad to help arrange for a UA9M callsign for any who would like to travel in that direction. Mike's info is Mike Shkirov UA9MI, PO Box 2056, Omsk 644119, Russia.—Amie]



Photo C. Picture of (L-R) Mike UA9MI, Alex UA9MR, Valery UA9NN, and Igor UA9MFW on Bering Island.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel
Packet: 4X1MK @
4Z4YU.ISR.MDLE

Techeat, Israel's first amateur radio satellite project, continues full steam ahead at the Technion Technical University in Haifa. Launch of the bird, which will feature an orbiting packet radio mailbox for hams, is slated for 1995.

Its BBS software has already been written, and it should soon be

in operation (terrestrially) from Bet Miller, home of the 4X4HF club, in Haifa. This will give people a taste of what it will be like connecting to the bird and will no doubt whet their appetites for the real thing. The simulated satellite BBS will be on AFSK FM, at first on 1200 baud and later switching to the faster 9600 baud rate. As with the Mode J type of operation slated for the satellite, those wishing to connect to the BBS will transmit on 2 metres and receive on 70 centimetres. The computer for this project has been donated by the Haifa Rotary Club. In a future report, we hope to have a more detailed re-

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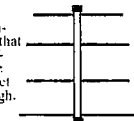
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CIRCLE 18 ON READER SERVICE CARD

port from some of the hams involved in the project.

With the sword of Damocles hanging over the wholeness of the 70 centimetre band, hams are beginning to wake up. In the last few weeks, three packet BBSs have been hastily set up on the band: on 430.400 MHz, a port of 4X4HF in Haifa; 433.450, 4X1RU in Herzliya (both of these part of the 4XNet and World-Wide Packet system) and 4X6SL in Tel-Aviv on 433.625, a private BBS on the air every evening, chock full of files and public domain software. All of these BBSs are working on standard 1200 baud.

By the time you read this, there should be a new UHF FM repeater activated in Jerusalem, and one is planned for Beersheva as well. What's in store for 70 centimetres in Israel? Is its fate sealed? To be continued...

[More next month when space permits.—Amie]

REPUBLIC OF KOREA

Byong-Joo Cho HL5AP
Room 401 CQ Building
157-7 Kwangan-2Dong, Nam-Ku
Pusan 608-102
Korea

Korea was proud to announce that EXPO '93, the Taejon International Exposition, will be held in Taedok Science Town, Taejon City, from August 7 to November 7, 1993. The theme is "The Challenge of a New Road to Developing" with a sub-theme of "Traditional and Modern Technologies for the Developing World, toward improved use and re-

cycling of resources."

The Taejon International Exposition and the Korean Amateur Radio League (KARL) are co-sponsoring an award, appropriately named the "EXPO '93 Award," that is available to all amateur radio stations and SWLs all over the world. Further information can be received from, and applications sent to: Award Desk, Korean Amateur Radio League, C.P.O. Box 162, Seoul, 100-601, Korea.

"With the sword of Damocles hanging over the wholeness of the 70 centimetre band, hams are beginning to wake up."

There will also be a Special Event Station set up at the EXPO. The callsign will be 6K93EXP during the EXPO '93 run. I am happy to report that I will spend some time at the operator's position and will be very happy to say "Hi" to my many friends.

RUSSIA

Gennady Kolmakov UA9MA
PO Box 341
Omsk-99
Russia

There are serious troubles looming on the horizon for the amateurs of the former USSR. Obsessed with "market economy," people in charge

of Amateur Radio Service on the government level have imposed (or will impose very soon) substantial fees for the privilege of operating on the air.

A First Class license (equivalent of the U.S. Extra) will cost a ham 120 rubles per annum. To enter any contests, one would fork over 240 rubles per year in addition to the above. It won't matter if you run 100 watts or 10 kW. Special calls call for yet more money. In U.S. currency

this doesn't look like much (\$1 = 500 rubles), but it sets a dangerous pattern—pay for what once was free and expect an increase any time. The opinions of ham ops were never requested, it seems.

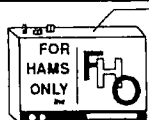
In addition, getting contest certificates via the bureau would cost five rubles, receiving a single card via the bureau now costs 50 kopecks, sending a single card abroad via the bureau would cost two rubles 15 kopecks.

An airmail letter from Russia to anywhere in the world now costs 75 rubles. Since the majority of hams can't afford to send airmail letters (the average salary now stands at 3,000-4,000 rubles per month) in

quantity, and because the foreign mail isn't getting through to Russia, those U-cards will become very rare indeed very soon. Moscow hams report piles upon piles of incoming QSLs at Box 88 that don't and won't get processed. The bureau is broke, can't pay employees and its own mailing expenses. Again, hold onto your CIS cards, don't mail them over here until the situation is resolved.

On a related subject, January 1993 was set as a time frame for the changeover of current amateur call-sign allocations to a new system. 95% of all Ukrainian calls will change and a substantial amount of Russian calls, if the new system is implemented. Other republics will see a full 100% change of existing calls. As was announced earlier, the new allocations were assigned without any consultations with hams, thus the amateur community of the former USSR republics is in a state of turmoil. Nobody knows what will take place, when and how. Letters were sent to the ITU, trying to stop the new assignments. Government offices responsible for communications were petitioned without any obvious results. There is talk about having hams retain the present call-sign system, while commercial and utility calls would be converted. At this time, it is all pure speculation and no decisions on this explosive topic were rendered. There would be no special calls assigned within the CIS for 1993. I was told, pending the outcome of the above.

As always, I will provide more details as they become available. 73 de UA9MA.



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52. K1DRN
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54. ZL2BLC
55. VE3EFX
56. W9MCJ
57. N6IV
58. KN8D
59. KC5YQ
60. WB6ITM
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62. K4LHH
63. VE2QO
64. KE5AT
65. W9SU
66. W3OOU
67. NR2E
68. KF5PE
69. N3FBN
70. KB4SJD
71. N3EZS
72. IK8GCS
73. WB4I
74. NG1S
75. WB7UUE
76. HK4EB
77. K0BFR
78. N7GMT (KF7SH)

79. AA4VN
80. KA1LMR
81. N8AXA
82. NM2I
83. KD9YB
84. HC2CG
85. VE1BXI
86. YC2OK
87. NR9NL
88. GM3UBF
89. 5Z4BP
90. I0AOF
91. VE1BN
92. KA2NRR
93. 5Z4DU
94. KB8ZM
95. HK4CCW
96. W6JQ
97. HC2AGT
98. WD5N/M
99. VE1BHR
100. VE1AGZ
101. K5A0B
102. KW2D
103. PY3ARZ
104. WB4ETD
105. N2FPB
106. KD3CQ
107. K4NNK
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39. 5N0WRE
40. KD2WQ
41. VE1ACK
42. N5JUJ
43. 9Q5NW
44. KB8BHE
45. I3VKW
46. KD3CR
47. N8IMZ
48. G0FWG
49. N2FPB
50. KE6KT
51. OZ9BX
52. NJIT
53. CE1YI
54. YB0HZL
55. JN3XLY
56. KA9MRU
57. CE7ZK
58. KB8DAE
59. K2EWB
60. NI5D
61. KD3CQ
62. KA4OTB
63. WB2VMV
64. KD4MM
65. KD9HT
66. KA3NIL
67. N0IDT
68. KA1TFU
69. KA4TMJ
70. JA4TF
71. KA3UNQ
72. KB8ZM
73. K2EWA
74. WA1S
75. PY4OY
76. W0OA
77. OZ1FNX
78. KA7EXD
79. ON6DP
80. VE1RJ
90. N6WK
91. WA3KKO
92. KB9ABI
93. SM0BNK
94. WA0QIT
95. 5Z4BH
96. OA4ANR
97. OD5ZZ
98. VE3ZD
99. HL5FRG
100. UB5LRS
101. PS7AB
102. KD1CT
103. DU1CHD
105. IK3ITX
106. VE2JWK
107. N7JXS
108. JM2PRM
109. HL5BUV
110. VE3GLX
111. KK6JY
112. EA6AAK
113. N3IHS
114. WA2CKP

250 COUNTRIES ENDORSEMENT

1. WB2DIN
2. IK8GCS
3. WD5N
4. K8MDU
5. KE2CG
6. CE1YI
7. CE7ZK
8. K2EWB
9. KD9HT
10. N7GMT
11. KD3CQ
12. KB8DAE
13. WA1S
14. PY4OY
15. VE1RJ
16. 5Z4BH
17. N2BI
18. I750156

300 COUNTRIES ENDORSEMENT

1. WB2DIN
2. IK8GCS
3. K2EWB
4. K8MDU
5. N7GMT
6. WA1S
7. PY4OY
8. KD3CQ
9. VE1RJ
10. UY5XE
11. IK3ITX
12. VU2SMN

200 COUNTRIES ENDORSEMENT

1. N3II
2. WB2DIN
3. K9FD
4. IK8GCS
5. N0AFW
6. WB1BVQ
7. VE4ACF
8. K16GI

350 COUNTRIES ENDORSEMENT

1. WB2DIN
2. PY4OY
3. UB4WZA

HAM HELP

Number 30 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. You may also upload a listing as E-mail to Sysop to the 73 BBS, (603) 924-9343, (8 data bits, 0 parity, 1 stop bit, 2400 baud), on Special Events Message Area #11. Specifically mention that your message is for publication. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Needed: Information on Tecraft Criterion series NU-VERTER Model 144, IF Freq. 14-18 mc. Thanks. *Art Coulombe W7HGK, 21 Yakima St., Walla Walla WA 99362.*

I'd like to exchange schematics/project ideas with other homebrewers. Please send a list of your projects, and I'll send a list of mine; or if you don't have a list of your own, please send an SASE and I'll send you a list of my projects (some have been published). *Klaus Spies, Lock Box 48185, Niles IL 60714-0185.*

Wanted: Knight R100A Receiver. Thank you. *Walter J. Stanis, Box 231347, San Diego CA 92194.*

I need manual/assembly instructions/schematic for VHF Engineering "Synthesizer II." This was how you made a rig programmable in the '70s. Will pay reasonable copy costs. *Joel S. Look W1KCR, 35 Goff Ave. Apt. 507, Pawtucket RI 02860.*

Wanted: Source info of antenna materials, such as tubing of various lengths and diameters; various types of element insulators; whip antenna rod material (such as one would find in commercially available HAM units). Ham is involved in the designing, experimenting and building of antennas. *Ron Zemljak N7LDQ, 140 Maude 'S' Canyon, Butte MT 59701.*

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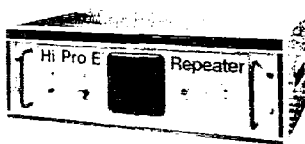
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SPECIAL EVENTS

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Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check **Special Events File Area #11** on our BBS (603-924-9343). For listings that were too late to get into publication.

OCT 2-3

VIRGINIA BEACH, VA Tidewater Radio Conventions, Inc., will present their 18th annual Virginia Beach Hamfest and Computer Fair/ARRL Virginia State Convention/Popular Communications SWL Convention, at the Virginia Beach Pavilion from 9 AM-5 PM Sat., and 9 AM-4 PM Sun. Speakers are Gordon West WB6NOA, and Roy Neal K6DUE. VE Exams, Flea Market, Tailgating, Forums, and more. Talk-in on 146.97. Order tickets (with SASE) from Manny Steiner K4DOR, 3512 Olympia Ln., Virginia Beach VA 23452. Tel. (804) 340-6105. Get Commercial info from Lewis Steingold W4BLO, 1008 Crabbers Cove Ln., Virginia Beach, VA 23452. Tel. (804) 486-3800.

OCT 3

ASHLAND, OH The North Central Ohio Hamfest will be held from 8 AM-3 PM at Ashland County Fairgrounds. Flea Market. Forums. 2m Foxhunt. Talk-in on 147.105+. Contact Wally Green, 3 East Liberty St., Ashland OH 44805. Tel. (419) 281-3903.

WARRINGTON, PA The Mt. Airy VHF Radio Club, Inc., (Pack Rats) will sponsor their Hamarama at the Rt. 611 Drive In. Talk-in on 146.52 (simplex). Gates open at 7 AM. Set-up at 6 AM. Contact K3EOD, (215) 742-3312.

OCT 8-9

AUGUSTA, GA The ARC of Augusta will sponsor a Special Event at the Augusta College Sports Complex, 3109 Wrightsboro Rd., from 6 PM-9 PM Fri.; 8 AM-5 PM Sat. Flea Market, VE Exams, Forums, Demos. Talk-in on 144.89/145.49, alt. 144.51/145.11. For tickets, tables, send check and SASE to ARC of Augusta, P.O. Box 3072, Augusta GA 30914-3072. For info, call Ed Butorajac KM4QQ, (706) 798-1918.

OCT 9

BELTON, TX Ham Expo '93 will be held by the Temple ARC, at the Expo Center in Belton, from 7 AM-2 PM. VE Exams. Free Test Bench. Transmitter Hunt. Call Eric N5WFL, (817) 986-1257 or Mike WA5EQQ, (817) 773-4768. Write to Temple ARC, 2014 S. 53rd, Temple TX 76504.

LIMA, OH The Northwest Ohio ARC will host a Hamfest at the Allen County Fairgrounds. Contact WB8BND, P.O. Box 211, Lima OH 45802. VE Exams; pre-register with completed 610 and fee of \$5.60 to ARRL-VEC, WB7Y, 1370 N. Stevick Rd., Lima OH 45807.

TEANECK, NJ The Bergen ARC will hold its annual Fall Hamfest from 8 AM-2 PM at Fairleigh Dickinson Univ. Contact Jim Joyce K2ZO, (201) 664-6725, before 10 PM. FCC VE Exams; contact BARA VE Hotline, (201) 797-0151 before 10 PM. Talk-in on 146.190/1790 and 145.620 simplex.

TITUSVILLE, FL A Hamfest will be held at Sandpoint Park from 9 AM-5 PM, by the Titusville ARC. Advance registration is required. Contact John Lowe KE4BCC, (407) 267-2000, or Bud Hughes K4CWG, (407) 267-3450. Talk-in on 146.910 (-600 kHz).

OCT 9-10

EL PASO, TX The annual Internat'l Hamfest will be held at the Texas Nat'l Guard Bldg., 9100 Gateway Blvd., North, Sat. from 8 AM-5 PM; Sun. 8 AM-3 PM. Seminars. QCWA Breakfast. VE Exams both days. Talk-in on 146.88. Contact Milly Wise W5OVH, P.O. Box 31628, El Paso TX 79931. Tel. (915) 751-4160.

MEMPHIS, TN MemFest '93 Greater Memphis Amateur Radio and Computer Show, will be held at Shelby Farms Show Place Arena, 105 Germantown Road So., by the Mid-South A.R.A. Time: Sat. 9 AM-4 PM; Sun. 9 AM-2 PM. VE Exams both days, 9 AM-Noon. Flea Market Info: Steve Cheeseman NX3W, 3290 New Getwell Suite 202, Memphis TN 38118. Tel. (901) 365-6621 (W); (901) 368-6781 (H). General and Exhibitor Info: Nita Wofford N4DON, 2966 Cordell, Memphis TN 38118. Tel. (901) 363-4971.

OCT 10

DURHAM, CT The Meriden ARC, the Middlesex ARC, and the Shoreline ARC, will jointly sponsor the "Nutmeg Hamfest" at the Fairgrounds in Durham. VE Exams. Talk-in on 147.96/36. Contact Jim McCandless N1IZF, (203) 349-3353, 6 PM-10 PM; packet: N1IZF @ W1NRG.CT.USAOAM. Mail: P.O. Box 193, Durham CT 06422.

WALL TOWNSHIP, NJ The 6th annual Shore Area Ham and Computerfest, sponsored jointly by the Jersey Shore ARA (JSARS), Neptune ARA, Ocean-Monmouth ARC (OMARC), and Garden State ARA (GSARA), will be held at the Allaire Airport. Doors open 0800-1600. VE Exams. Talk-in on 145.110 (NK20) for cars; UNICOM 123.00 MHz for aircraft. Get details from Al Jackson NK20, (908) 922-8121. For tables/tickets, write to Shore Area Hamfest, P.O. Box 635, Eatontown NJ 07724-0635.

WAUKESHA, WI The Kettle Moraine RAC Inc., will hold its 15th annual Ham and Computer Swapfest at the Waukesha County Exposition Center, Hwys J & FT. Doors open 8 AM-1 PM. VE Exams by the Badger Examiners. Advance tickets \$4; 4' tables \$5; send a SASE and check payable to KMRA Swapfest, P.O. Box 411, Waukesha WI 53187-0411.

OCT 16

FRANKLIN, PA The Fort Venango Mike & Key Club will hold a Ham Auction/Flea Market at the Venango County 4-H Fairgrounds, Rt # 62, starting at 8 AM. Auction begins at 10 AM. Talk-in on 147.12+, 145.23-, and 145.19- MHz. Contact Jerry Almes W3DTW, (814) 432-3647, or Bruno Wolozyn K3MHB, (814) 677-8694. Or write to The Ft. Venango Mike & Key Club, RD #1, P.O. Box 591, Cranberry PA 16319.

GRAND FORKS, ND Fox ARC will sponsor a Hamfest at Grand Forks Civic Auditorium, 615-1 Ave. N., beginning at 8 AM. VE Exams at 10 AM, walk-ins welcome. Talk-in on 146.94. Contact Bob Smith ND1H, 1203 Shakespeare Rd., Grand Forks ND. Tel. (701) 746-9498.

GRAY, TN The 13th annual Tri-Cities Hamfest will be held at the Appalachian

Fair Grounds, located off I-181 in Gray. Flea Market. Sponsors: Kingsport, Bristol, and Johnson City Radio Clubs. Mail inquiries to Tri-Cities Hamfest, P.O. Box 3682 CRS, Johnson City TN 37602.

SANFORD, NC A Fall Festival will be held from 8 AM-4 PM by the Central Carolina ARS. Location: Lions Club Fairgrounds, 7th & Weatherspoon Sts. Contact April Maggart KD4QMU, 8512 Deep River Rd., Sanford NC 27330.

STARKE, FL Bradford County Fairgrounds, US 301 North of Starke, will be the location for the 3rd annual Starke Hamfest, sponsored by the ARC - Bradford Area. Time: 0800-1600 hrs. Talk-in on 145.150- and 146.520 simplex. Contact Donna KC4MXX, (904) 954-9491, or Tony WB2FGL, (904) 964-9328. For reservations, make check payable to ARC - Bradford Area, c/o Tony Spatafore WB2FGL, P.O. Box 852, Starke FL 32091.

OCT 17

CAMBRIDGE, MA A Tailgate Electronics, Computer and Amateur Radio Flea Market will be held from 9 AM-2 PM at Albany and Main Sts. Call (617) 253-3776. Mail reservations before Oct. 5th to W1GSL, P.O. Box 82 MIT, BR., Cambridge MA 02139. Sponsors: MIT Radio Soc., and the Harvard Wireless Club. Talk-in on 146.52 and 449.725/444.725 pl 2A W1XMR.

CENTRALIA, IL The Centralia Wireless Assn., Inc., will hold its annual Hamfest at the Kaskaskia College Gym, 3 mi. NW of Centralia. Doors open at 8 AM. Talk-in on 147.271.87 and 443.21448.2. VE Exams at 11 AM, walk-ins accepted. Contact Bud King WA9U, (618) 532-6606. Mail ticket orders with a SASE to Centralia Wireless Assn., Inc., Hamfest Tickets, P.O. Box 1166, Centralia IL 62801.

MILAN, OH The Irelands Area Repeater Assn. will hold their 2nd annual Hamfest at the Elove Career Center, from 8 AM-4 PM. Talk-in on WB8LLY Rptr. 146.805. Contact Carol Richards A1BV, (419) 433-6624.

TUCSON, AZ The 5th annual Tucson Hamfest, sponsored by Old Pueblo RC, ARRL, ARCA, will be held from 7 AM-1 PM at DeAnza Drive-In, 22nd St. & Alvernon Way. Talk-in on 146.221.82, 146.28/88, and 146.52 simplex. Contact A.J. Pawlowski KB7KZ, 3418 W. Green Trees Dr., Tucson AZ 85741. Tel. (602) 742-2605.

OCT 23

SUMTER, SC The Sumter ARA will present their 7th annual Hamfest and South Carolina's 1993 ARRL Convention, from 8 AM-4 PM at Sumter County Exhibition Center, 700 W. Liberty St. VE Exams for Walk-ins Only. For VE Exam info, call Dan Mask WB5SGH, (803) 775-9106. Dealers, call Hap Griffin WA4UMU, (803) 469-6381. For written info, write to S.A.R.A. - Hamfest, P.O. Box 193, Sumter SC 29150.

OCT 23-24

CHATTANOOGA, TN The Hamfest Chattanooga Amateur Radio & Computer Convention will be sponsored by the Chattanooga ARC, Sat. 9 AM-5 PM; Sun. 9

AM-3 PM. Talk-in on 146.19/179. General info contact Charles E. Curle AD4F, 8719 Snow Hill Rd., Ooltewah TN 37363. Dealer info/reservations: Barbara Gregory, 8619 Smokerise Ln., Chattanooga TN 37421. Tel. (nights) (615) 892-8889. Flea Market info: Lou Carter, 107 South Bragg Ave., Lookout Mountain TN 37350. Tel. (nights) (615) 821-4043.

MOBILE, AL The Mobile ARC will hold a Ham and Computer Fest at Abba Shrine Temple, 7700 Hitt Rd., off Shillinger Rd. Time: Sat. 8 AM-4 PM; Sun. 8 AM-3 PM. VE Exams both days at 9 AM. Contact Louis AC4EN. Talk-in on 146.82/22. Rag-Chew 149.94/34. For details, call Richard Ireland KD4TTD, (205) 824-2749, or write M.A.R.C., P.O. Box 81791, Mobile AL 36689.

PALM BEACH, FL The West Palm Beach ARC will sponsor their 1st annual High Speed CW Contest, beginning at 1 PM at the Palm Beach County Fairgrounds. For details, contact Ted Herrman AE8G, 301 North M St., Lake Worth FL 33460. Tel. (407) 586-7940; FAX (407) 585-3466.

OCT 24

GOLDEN, CO The Rocky Mountain Radio League, Inc., will present the 1993 RMRL Hamfest from 8 AM-2 PM at Jefferson County Fairgrounds, 15200 W. 6th Ave. VE Exams. ARRL Forum. Talk-in on 144.62/145.22 MHz. Contact Joe Dickinson W7OC, (303) 795-3397.

WARREN, MI The Ulica Shelby Emergency Comm. Assn. will hold their USECA Swap from 8 AM-2 PM, at Student Community Center (K-Bldg.), Macomb Community College, South Campus. VE Exams (pre-registration required) call Bill NBVCV, (313) 468-8345. Table info: Dave NB0EV, (313) 792-0791; or Virginia NB8NLS, (313) 268-0691. Talk-in on 147.18+, 147.42 simplex. For Club info, call Dave KF8CT, (313) 268-6730. Mail pre-registration payments with a SASE to Virginia Przekala NB8NLS, 34473 Coachwood, Sterling Hts MI 48312.

WESTMINSTER, MD The Radio Clubs of Carroll County MD and Penn-Mar PA, will be holding the 4th annual Mason-Dixon Computer & Hamfest at the Carroll County Ag Center, starting at 8 AM. VE Exam registration begins at 8 AM; pre-registration requested; contact Page Evans NE3P, (717) 359-7610.

OCT 30

EAST LYME, CT The Tri-City ARC will hold its annual Fall Auction at the Senior Citizens Center, Waterford Municipal Complex, from 10 AM till sold out. Bring your equipment to be auctioned. Talk-in on 146.071.67 Rptr. For info call KA1BB at (203) 739-8016.

FREDERICKSBURG, VA VE Exams will be given at the Rappahannock Library in Fredericksburg. For details, call AC4SK at (703) 373-7076, or AC4MB at (703) 891-5581.

ST. PAUL, MN The Hamfest Minnesota & Computer Expo, sponsored by the Twin Cities FM Club, will be held in the Main Arena at the St. Paul Civic Center, 143 West 4th St. Flea Market. VE Exams. Educational and Fun Seminars. Talk-in on

146.16/76 Rptr. For info, write to *Twain Cities FM Club*, P.O. Box 5598, Hopkins MI 55343, or call the *Hamfest Minnesota Info Line*, (612) 535-0637.

OCT 31

LEBANON, IN The Boone & Clinton County ARCs will co-sponsor a Hamfest from 8 AM-4 PM at the Boone County 4-H Fairgrounds, Warm & Dry Community Bldg. Flea Market. VE Exams near by. Talk-in on 147.105 and 443.150. Contact *Tim French KA9WDJ*, (317) 324-2618; *Don Jackman N9ILX*, (317) 482-5211; or *Don Lecklitter N9GBO*, (317) 654-6580. Or write to Boone County ARC, P.O. Box 186, Lebanon IN 46052.

MARION, OH The Marion ARC will present its 19th annual "Heart of Ohio Hamfest and Computer Show" at the Marion County Fairgrounds Coliseum, from 8 AM-3 PM. Talk-in on 147.90/30 Rptr. Contact *Steve Eckard WS8S*, 6583 South St. Meeker, Marion OH 43302. Tel. (614) 499-3565.

NOV 6

CARTHAGE, MO The Carthage AR Soc. Hamfest will be held at the Carthage Memorial Hall at the intersection of Oak & Garrison Sts., from 8 AM-1 PM. Talk-in on 147.42 simplex. Contact *Jim Dixon WX0J*, or write to Carthage ARC, P.O. Box 783, Carthage MO 64836. Tel. (417) 358-4126.

COOKEVILLE, TN The Cookeville Rptr. Assn. and The Tennessee Tech ARS will co-sponsor the 3rd annual Cookeville Hamfest at Hooper Eblen Center on the campus of TTU. Time: 8 AM-4 PM. Talk-in on 147.21+. VE Exams at 10 AM. Contact

Rich KD4ABC, (615) 528-7171 or *TTARS*, WA4UCE, TTU Box 5262, Cookeville TN 38505. Tel. (615) 372-3043.

ENID, OK Hoover Bldg., Garfield County Fairgrounds at Oxford St. and N. 4th, is the location for a Hamfest being sponsored by the Enid ARC. VE Exams at 10 AM (walk-ins welcome). Talk-in on 145.29/144.69. Contact *Fred N5QJX*, (405) 242-3551, or *Tom N5LWT*, (405) 233-8473.

EUSTIS, FL The Lake AR Assn. will hold their annual Hamfest and Electronics Expo at the Lake County Fairgrounds from 9 AM-5 PM. W5YI Testing for all classes, starting at 1 PM. Radio and ATV Demos. Contact *Cole A. Ruck KC4UIG*, (407) 273-1624 (eves); or *Pat Paris WD4LXN*, (904) 669-7279 (eves).

FERNOALE, WA The Washington Mt. Baker ARC Flea Market will be held from 9 AM-4 PM at Ferndale Band Boosters Bingo Hall, NW corner of Interstate 5 and Smith Rd. overpass. VE Exams. Contact *Terry Andrew VE7BUS/W7*, 1009 Glenning St., Lynden WA 98264. Tel. (206) 354-5868.

MILWAUKEE, WI The Milwaukee Repeater Club will sponsor the 9th annual "6.91 Friendly Fest" from 8 AM-Noon at St. John the Evangelist Congregation, 8500 W. Cold Spring Rd. Talk-in on 146.91- and on 146.52. VE Exams. Contact *The Milwaukee Repeater Club*, P.O. Box 2123, Milwaukee WI 53201. Reservation deadline Oct. 28th.

NOV 6-7

LONG ISLAND, NY "HamExpo '93 Weekend" and ARRL Section Convention, sponsored by the Radio Central ARC, will be held at Suffolk Community College from 9 AM-4 PM. Flea Market. Computer Show. VE Exams, and more. Group hotel rates. Talk-in on 145.150-4Z or 449.525-2A. Contact *Valerie DeRicco N2NYB*, (516) 874-3669 or *John Mark KB2QQ*, (516) 689-6343.

SPECIAL EVENT STATIONS

OCT 2

ALAMOGORDO, NM The Alamogordo ARC will conduct their 3rd Special Event operation, sponsored by the International Space Hall of Fame, to honor new inductees. Station WA5IPS will operate from atop the Space Hall. Frequencies: SSB - 28.480/490 MHz from 1600-1800 UTC; General phone bands on 15 and 20 meters from 1800-2300 UTC. We will operate in the 20 meter phone band if propagation is poor. Special QSLs will be sent from the Space Hall of Fame and will be certified by A.A.R.C. members. Mail QSL requests to *International Space Hall of Fame*, Route 2001 - P.O. Box 533, Alamogordo NM 88311-0533. SWL requests will be honored.

MATTOON, IL The Moultrie ARC will operate W9BIL to commemorate the annual Chocolate Harvest Celebration. Operation will be in the General 40, 20, and 15 meter bands, and the Novice 10 meter subband. For a certificate, send QSL and a SASE to *Bryon Abrams KB9BWS*, P.O. Box 242, Findlay IL 62534-0242.

RICHARDSON, TX The Alcatel ARA will operate Station N5TBQ (Texas Best Quality) 1500Z-2100Z, from the Open House

site of Alcatel Network Systems, Inc. Operation will be in the General phone portions of 40, 20, 15, and 10 meters. For a unique QSL card, send contact report to *Alcatel Network Systems, Inc.*, AARA, M/S 401-212, 1225 North Alma Rd., Richardson TX 75081-2206.

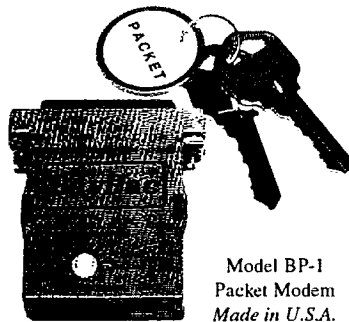
OCT 6-10

HILLSBOROUGH, NC The Orange County Radio Amateurs will commemorate the bicentennial of the founding of the Univ. of North Carolina at Chapel Hill. SE Stations will operate, with a /UNC suffix, on the lower 25 kHz of the General portions of the 80, 40, 20, and 15 meter bands SSB, from 2300Z-0300Z on Oct. 6-8. In addition to the above band segments, SSB operation on the lower 50 kHz of the Novice portion of 10 meters (propagation allowing), will take place Oct. 9-10, from 1200Z-0000Z. An 8 1/2" x 11" certificate will be endorsed for all bands worked, with a special endorsement for UNC graduates. For a certificate, mail an SASE to *David J. Snyder N2MLU*, 600 S. Churton St., Apt. #66, Hillsborough NC 27278.

OCT 9-10

CAMANO ISLAND, WA The 3rd annual "Slug, Oyster and DX Festival" honors our friends the Mollusks, and is sponsored by the West Seattle ARC (W7AW). Operation will be Oct. 9 1500-0400 UTC to Oct. 10, 1500-2100 UTC. Frequencies: 21.052 MHz CW, 14.235 MHz SSB, 7.045 MHz CW, 3.930 MHz SSB. For a colorful certificate showing a slug and oyster at play, send your QSL and a large SASE to *West Seattle ARC*, c/o F. Tate, 10230 4th Ave. SW, Seattle WA 98146.

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TORRANCE, CA The South Bay ARC will operate KN6JN 1700Z-2400Z on the 2nd annual Torrance Air Fair in So. CA. Operations will be on General phone portions of 15 and 20 meters and Novice portion of 10 meters; also on 145.77 simplex and 224.38 rpt. For a certificate, send QSL and 9" x 12" SASE to SBARC, P.O. Box 536, Torrance CA 90508.

OCT 15-16

ST. LAWRENCE COUNTY, NY The North Country ARC will operate N2PSL to commemorate the Founding of the NCARC. Operation will be in the lower 25 kHz of the General portion of 80, 40, 20 meters, and the 10 meter Novice subband. For a QSL, send QSL and SASE to NCARC, c/o Pete Baltradis N2LW, Rt. 1 Box 206, Norwood NY 13668 USA.

OCT 15-17

UNION, KY The Northern Kentucky ARC will operate K4CO 1400Z-2200Z from Big Bone Lick State Park, in conjunction with the annual Salt Festival. Operation will be on 40, 20, and 10 meters; also, 146.375+ Rpt. For a certificate, send 4" x 9" SASE and contact number to NKARC, P.O. Box 1062, Covington KY 41012-1062.

OCT 16

SAN BERNADINO, CA The Citrus Belt

ARC will be operating Station W6JBT from the Patton State Hosp., to commemorate the admission of the first patient to the hospital 100 years ago. Operation will be from 1500 UTC Oct. 16th-1500 UTC Oct. 17th. Frequencies: Phone - 7.270, 14.270, 21.350, 28.350; 145.850 144-148 MHz band; 224.860 222-225 MHz band. For a certificate, send QSL and a 9" x 12" SASE to Citrus Bell ARC, P.O. Box 3788, San Bernardino CA 92413-3788.

SANTA ROSA ISLAND, FL The Serious Hams ARC will operate N4MAD from Ft. Pickens State Park 1200Z-2000Z on 40, 20, 15, and 10 meters in the CW and voice portions of the bands, near the lower edge of the General portion of each band. Santa Rosa Island is IOTA-142. For a special QSL, send SASE and contact number to AD4BU, 10697 Bridge Creek Dr., Pensacola FL 32506.

OCT 16-17

DETROIT, MI The Wayne County ARPSC will operate WY3Q/8 from 1400Z Oct. 16-2200Z Oct. 17, to commemorate the 16th annual running of the Detroit Free Press/Mazda Intemat'l Marathon. Operation will be in the General 80-15 meter phone subbands and the Novice phone subbands on 10 meters. For a QSL card, send QSL and SASE to Bill Gilbert, 222 Cleveland, Trenton MI 48183.

OCT 16-23

FORT WORTH, TX The Menasco ARC will be on the air as a special event Station celebrating Menasco Aerosystems' 37 years of operating in the State of Texas. Operation will be at 28.425 and 21.060 or

21.125 plus or minus QRM. To receive a special 8 1/2" x 11" certificate, send a large SASE to the control operator.

OCT 20-22

NEW YORK CITY, NY The "22 Crew" will operate WB2JKJ from the HQ of the Radio Club of Junior HS 22, to celebrate the 13th Anniversary of NYC's largest Ham Club and EDUCOM (Education Thru Communication). Join them on 7.238 MHz. from 1200-1300 UTC, then on to 21.395 till 2000 UTC, Oct. 20-22. For an outrageous QSL and surprise package, write to RC of JHS 22, P.O. Box 1052, New York, NY 10002, or FAX to (516) 674-9600.

OCT 23

EDISON, NJ The Piscataway ARC will operate Station AA2KS 1300Z-2200Z, to celebrate Edison's discovery of the electric light bulb. Operation will be on the General portion of 40, 20, 15 meters and Novice 10 meters. For a special QSL card send QSL and SASE to Piscataway ARC, P.O. Box 1233, Piscataway NJ 08854.

OCT 23-24

RIVERSIDE, CA The Moreno Valley ARA, Team March ARC, and the March Air Force Base MARS station will operate K16GD during the March AFB Open House. Operations will be 1600Z-2200Z both days, on the General CW and phone sub-bands of 40, 20, and 15 meters. Also the Novice section of 10 meters. For a special certificate, send \$100 and contact number to MVARA, P.O. Box 7642, Moreno Valley CA 92552. For more info, contact MVARA or packet N6YIH@N6YIH.#soca.ca.usa.na.

OCT 30

ACCOMACK COUNTY, VA The OH-KY-IN ARS will activate an IOTA during the CQ WW contest. The operation will be on all bands. The ITA will be one of the offshore islands in Virginia. Activity during the contest will be from Chincoteague Island, NA83. On Oct. 28 there will be a one day operation from Asateague Island, NA139. The call used will be K8SCH/4. The QSL route for both will be John Hugenlober, Sr. N8FU, 4441 Andreas Ave., Cincinnati OH 45211. Please enclose an SASE.

OCT 30-31

RIVERSIDE, CA Moreno Valley ARA, Team March ARC, and the March Air Force Base MARS station will operate K16GD during the March AFB Open House. Operations will be 1600Z-2200Z both days, on the lower 25 kHz of the General subbands and Novice 10 meters. Operations will be SSB phone and CW, plus 145.560s and 146.655R pl 103.5. For a special USAF Certificate, send QSL and \$1.00 to MVARA, P.O. Box 7642, Moreno Valley CA 92552.

OCT 31-NOV 1

BREVARD, NC The Transylvania County ARC will operate W4ZCB to celebrate Halloween from the Devil's Courthouse in Transylvania County. Operation will be from 2000Z Oct. 31-0200Z Nov. 1. Frequencies: 7.234, 14.295, 21.365, 28.335 SSB, and 146.52 FM simplex. For a certificate, send a legal size or 9" x 12" SASE to Harold Johnson W4ZCB, 115 Kindy Forest Dr., Hendersonville NC 28739.

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CIRCLE 121 ON READER SERVICE CARD

NEVER SAY DIE

Continued from page 4

What do you talk about when you make a contact? Are you actually talking about anything, or is your mike fright so bad that all you can do is list the model numbers of your equipment and antennas, mention the weather, spell out your name and turn it back? Go get a life! For heaven's sake do something you can talk about! I don't give a damn what rig you're using. I don't care what brand of antenna you were able to afford. I don't care that it's raining. I want to know something about you.

No, I don't want to sit and listen while you rant about something you're emotionally disturbed about. That's no fun. But I would be interested in any interesting ham adventures you've had. If you've read my editorials for any time you know about everything I'm interested in. I'm into all kinds of hobbies and several active sports. I read a ton of books and magazines and will be most interested in anything you've read and found interesting that I might have missed. I love getting letters from readers giving me leads on books I'll enjoy reading or music I might enjoy hearing.

What I don't need is to get on a repeater where there's some resident retired old codger who rambles on endlessly about nothing, month after month. You've got one of those around, right? Heck, I'd even get

bored listening to someone like this year's Ham O' The Year award winner and his obsession with me and my admittedly adventurous life. These old guys must have something that interests them other than ham radio. Or, if they have never done anything in their lives outside of hamming, isn't there something interesting they've done in amateur radio?

I've told you how much fun I had hamming from the demilitarized zone between North and South Korea as HL9WG, right? Or getting on the air as 7P8CA from Lesotho. You can surely get a good QSO going by asking if they've read what that arrogant, egotistical asshole Wayne Green wrote this month. Well, don't use those exact words. They might offend some Nervous Nelly listening in. We've enough garbage-mouth stuff going on without you contributing to the mess. The language you use on the air is a clear announcement of your class in society. After a few words we know right where you fit in, so if we hear you using bad language and fractured grammar, we wonder why you aren't on CB where you belong. How did an ignorant slob like that get a ham ticket? Maybe that code test isn't enough of an obstacle.

I suppose I'm preaching to the choir. The chaps who need my advice the most wouldn't read 73 if their life depended on it. Not with all that ARRL bashing they think I do. Of course they've never read 73, so they're going by word of mouth about my writing.

I keep trying to get you to break loose and go on a DXpedition. That'll give you something interesting to talk about for years. You might even get in to slow-scan just so you can show your slides. And I'll love watching 'em. Yes, I know, you can't afford anything like that. Unless you're really into poverty as a way of life, there are plenty of easy DXpedition places to visit and have the time of your life.

Heck, you can drive to Nova Scotia and take a boat or plane to St. Pierre for a surprisingly low bucks. It's a bargain place to visit and they love visiting hams. I'm frugal, and I've never cared much about making money, and hate spending it. At least on myself. I've spent millions helping other people start businesses.

The Caribbean is another bargain place to visit and there are a dozen or so fairly rare spots you can activate. You can get there in a day, so you don't even need to have more than a week off to have a ball. Try it. Then write and thank me for pushing you. Also, let's see an article for 73 or *Radio Fun*.

What are you into that you can talk about? Bicycling? Kayaking? Scuba? Roller blades? Ultra-lights? Para-planing? Rallying? Sky diving? Ballooning? Gliding? Model planes? You're not a one-dimensional person, are you?

Many years ago I suggested we set up some net times and frequencies for hams with similar interests to meet

and talk. Nothing came of it. One problem with nets is that once you have more than two or three stations involved there's a reluctance to say much. The result is that a bunch of ops check into the net and say hello. And that's about it.

There's a weekly submariners net. I called in a couple times. Now, I've got hours of interesting submarine yams to tell, but I never found an opportunity. So I stopped checking in. The net was on 20m, which meant that half of the checkins couldn't hear the other half, which puts a real chill on talking for any length of time. Interest groups should stick to 80m and maybe 160m, where everyone can hear everyone else. Or perhaps 2m via a repeater.

Always try to be your very best at anything you do. So when it comes to hamming, invest what it takes to make you the most interesting ham on the band to talk with. Work hard at it. Tape yourself and take the time to critique it. Be upbeat. No one likes a sour apple, so griping and negativity will have people avoiding you the next time around. I get letters from hams who obviously are devoting their lives to making as many people unhappy as possible. I sure hate when I run into 'em on the air.

That last QSO... was that the very best you're able to do?

Trivia

One of the ham rags made a great big deal out of a TV production outfit

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that rented some 2m HTs instead of commercial frequency HTs from a commercial communications firm. They innocently used 'em. We'll eventually hear whether the rental company got conned when they bought the HTs or if they knew the frequencies were wrong. But shame on blaming the TV production company . . . another Chicken-Little hysterical reaction.

The ARRL vs. gays score seems to be gays 2, ARRL 0. The League backed down on their refusal to continue publishing classified ads soliciting gay hams to join their movement. Now the gays, not satisfied with just winning, are suing for damages. Har-de-har . . . another item for the "Only In America" record book.

Getting Involved

As a communications and technology expert, you should consider becoming involved in local activities. Business people, educators, politicians, and even your local bureaucrats are beginning to recognize that the information age is dawning on America and they'd better damn well get aboard or they're going to be left behind by the rest of the world.

They've been hearing John Scully, now the chairman of Apple, talk about the information highway of the future, while all most people can see right now is more like a cow path. They see that Singapore is setting about installing fiber optic cable into every home and business in the country. In

France, every home has an on-line computer connected to a national data base.

We've been seeing the changes in our own lives as our ham repeaters have turned into cellular telephone systems. We've seen facsimile explode. Those of you who are awake have seen pocket communicators which handle voice and fax. We've seen national paging systems grow.

As a radio amateur, naturally you're expected by your neighbors to be an expert on communications and technology. Thus, when a few local politicians start getting concerned over the general ignorance of these highly technical matters, naturally they're going to turn to you for advice on how to get your county or state more tuned in with the future. Business people must find out how to take advantage of this technology and not be left behind by other parts of the country . . . or other countries. Schools must start turning out workers familiar with information and communications technology.

How prepared are you for this? How much do you know about what's available right now in technology, much less what's developing? Are you still sitting there, happily clacking away with your beloved old hand key, while the world is going to digital voice communications? And probably using spread-spectrum?

While we're communicating at 5 wpm by code, the world is moving to digital communications because digital

radio provides about three times the coverage with a hundredth of the power. Further, it's easy to put 10 to 20 people all on one channel without mutual interference. Heck, they can even talk with each other, just as we do on the telephone. And, by using satellites in the link, the 10 to 20 people can be in 10 to 20 different countries. Yes, we could do all this via amateur radio, if we had anyone pioneering new technologies in our fraternity.

Alas, all too many hams prefer to remain fat, dumb, and happy. Ooops, make that fat, dumb, and unhappy . . . because they're forever grousing and kvetching on the air about things. Those damned no-coders. The rotten CBers. Lousy phone patches. Stinking pile-ups. Miserable contests crapping up the bands. That fathead and his little band of degenerates puking their venom on 14.313. The endless self-promotion broadcasts by an internationally famous ego case on 14.275. And worst, that awful Wayne Green! How can someone who sounds so nice on the air write such abrasive baloney?

I digress. My aim was to stir some deep feelings of guilt for the way you've wasted your ham life on inconsequential. Well-deserved guilt. You've been skimming the cream and not paying your dues. That's pure American . . . get the most you can for the least effort. Never mind the hard work . . . a concept we left behind back in the 1950s. That's something

those lousy, rotten Asians do when they sneak into our country and become successful, while we're gradually losing our quality of life.

Is change possible? Or are you too solidly inculcated with the baby-boom rationale? Are you too involved with TV, a little rag-chewing on the air, a rented movie once or twice a week, ball games, maybe some bowling? If I some way could find some people to write articles on new technologies that were written in a language you could understand, would you take the time to read 'em? Let me grind that one in a little harder. If I could get such articles and publish 'em, would you allocate a half hour or so at club meetings to discuss 'em? Okay, that's going too far. Maybe I should continue to publish feel-good articles and stop poking you with a stick.

When I point out that I'm not asking anyone to do something I haven't done myself, I get angry stares. Egotistical braggart. When I point out that it's exciting to get up on a mountain and make 10 GHz contacts with seven states . . . and that the equipment it takes is inexpensive and easy to build . . . I get shifty glances. I had a ball pioneering RTTY. Ditto SSTV. Ditto SSB. Ditto NBFM. It was fun learning. It was even more fun doing. And here we are in 1993 and there are more incredibly exciting horizons for us than ever before. Meanwhile, most hams seem to be looking backwards. Looking back fondly at Morse code, the

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communications medium of the 1920s and 1930s. Looking back lovingly at our archaic license structure, which is collapsing around us. Our national society is a radio relay league, aptly named when relaying was the only way to cover much distance by radio . . . around 80 years ago. Bummer.

New Hampshire and the 21st Century

An invitation came from Congressman Dick Swett (D-NH) to a meeting in nearby Keene proposing the organization of a 1994 National Information Technologies Conference at Keene State College. Swett spoke to (and with) the group via satellite video from Washington. We could see him, but the video was one way, so he couldn't see us. We could hear him just fine, but he had trouble hearing us, and then the audio link was lost.

There were around 25 business and education leaders present. We struggled to try and understand just what Swett or anyone involved in the project thought an Information Technologies Conference would involve . . . what the benefits would be and to whom . . . and who was going to pay for all this. There seemed to be a good deal of confusion about this. Swett read a long, prepared Beltway language speech . . . a lot about pro-activity. I'm pretty good at translating various American dialects into plain English, but I got lost. So did everyone else, fortunately. I'm not exactly sure what pro-activity is, but I'm all for it,

and it describes me to a tee.

There were some vague references to information technology somehow benefiting local businesses, which is almost obvious enough not to have to be defended. And there was the need for Keene State College to start producing the information technology work force local businesses are going to need.

The hope was that Keene State and the local business leaders would work together to organize the conference. There was some mumbling about getting federal funding, but first they needed \$50,000 from the business community as seed money to get the project started. This would take care of the next three months, when they hoped federal funding would kick in. Hmmm. Fifty big ones for three months? The obfuscation almost smothered us, but I think what they had in mind was sending someone or a small group around the world to look into information technology elsewhere. There was some mention of site selection. I quickly offered to handle the site seeing part of the project for them as soon as they had the \$50G, pointing out my extensive qualifications and contacts in the communications community everywhere in the world. I don't think they heard me. Perhaps they already had some volunteers with their eyes on the \$50G.

Far's I could see, the local business community was much more interested in the fruit and cheese plate than do-

nating to this phantom project. But hey, you never know. The last two times I volunteered to go on expense-paid around-the-world trips I won out, so my foot seems to automatically extend at the slightest hint, looking for any running boards to climb on . . . so to speak. You remember running boards, right? You've seen 'em in the old movies, with gangsters hanging on, shooting.

Yes, it would be nice if Keene could attract some of the coming high-tech manufacturing that the communications and information technology industries will make possible. And if Keene State could help provide high-tech career workers, the chances are good that the area would benefit from this by attracting such businesses. They'd better start working out some methods for helping to finance these startups though, otherwise they and the workers will go where the money is.

Of course adding some technical courses to a state college isn't going to do squat. They've got to train teachers and get the New Hampshire K-12 schools to change. Big change. You don't become much of an engineer, technician or scientist with a couple years of college. You need to get started when you are in the 5th grade if you're going to go anywhere and do anything. That's why I keep nudging you to visit your local schools and fire up the 5th graders. Get 'em excited. Get these noisy, bothersome little nui-

sances to your ham club and poison their dirty little minds with our fascinating hobby. It happened to me, and like all such addicts, I want to spread the misery.

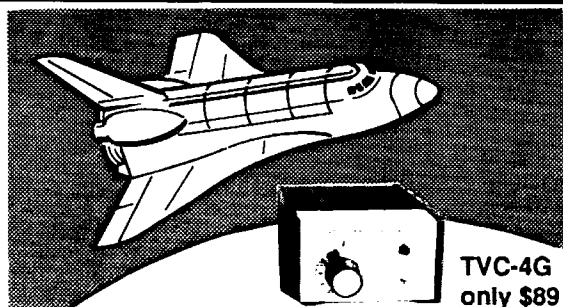
Swett promised that if we organized a national conference he'd try to get Clinton to come. And if he failed with that, to get him for us via TV. Failing that, he'd push for some other high official to come or at least address us via closed-circuit TV. Let's see, who's the new janitor at the White House?

I still haven't a clue as to what the site investigation team was expecting to find out on their \$50G trip. I did miss out on a great opportunity. I wish I was faster on my feet on these things. I should have jumped up and started a collection plate around, pledging \$10 to get the fund going. My life is full of missed opportunities like that.

You Read It Here First!

Some time back, when I wrote about homosexuals in amateur radio, I got several heated letters from Bible-thumping religious fanatics. They were incensed that I'd suggested that there was a genetic element to this deviation from the norm. By the way, homosexuality is just one of a wide variety of deviations which cause people trouble. Being too tall, too short, too stupid, too intelligent, too ugly, too pretty, too skinny, too fat, too buxom, too flat-chested, and so on . . . all the "loos" . . . are deviations that we don't

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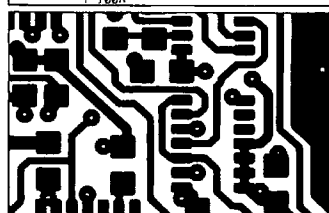
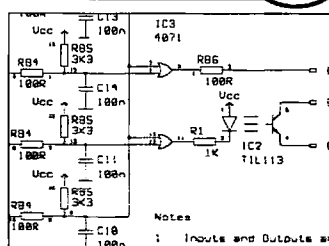
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Welcome

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AWARD
1989

take with grace and understanding. We also make fun of deviant ears, noses, hairlines, and so on. Ask Perot.

The overwrought were upset at gays (aka homos, queers, fags) advertising in ham magazines, seeking members for their gay ham society, Lambda. I pointed out that science had shown that there seems to be a genetic predisposition for gayness and that my own research in the field had shown that the gays I worked with had had these feelings from their earliest memories. In my work I've been able to trace back virtually all psychological abnormalities to specific triggers during painful childhood and even prenatal experiences. A few were resolved by taking a tolerant approach to past life "memories." But gayness, in the cases I worked with, didn't fit into the normal psychological trigger pattern. It seemed to have a genetic basis. It's therefore interesting that recent scientific genetic research has confirmed this.

Now, I'm not by any means saying that all gay activity is genetically manifested. If you're at all read in history you know that in societies where homosexuality was condoned, it was widely practiced, so obviously there's a strong psychological component involved. So, though we may abhor the practice of homosexuality as a cultural bias today, we can't help being sympathetic to those who are genetically driven, despite society's censure.

It's the male homosexual lifestyle that attracts the most outrage and the

least sympathy when AIDS strikes. Kinsey's research showed that while the average lesbian has less than 10 sexual partners, the typical male homosexual in America has had over 500! We know that male sexuality is much more destructive than female when not controlled. Men rape, not women. Only men engage in fetishes. Only men are sexually sadistic. Men far more often wander from partner to partner.

It was Judaism that changed things. Judaism, and its spin-off, Christianity. Up until then homosexuality was accepted. It was exalted in Greece, commonly accepted in Rome, and is still popular in the Arab world. It was prevalent among the pre-Columbian Americans, the Celts, Gauls, pre-Norman English, Chinese, Japanese, and Thai (see *The Public Interest* #112). So here in America we've been inculcated with the Jewish/Christian beliefs. I'm not sure that even recognizing that we've been brainwashed by our religious training will allow many of us to be tolerant.

So we hams are outraged when we learn that some of our outstanding hams have been convicted of molesting young boys. Indeed, one of our best-known repeater pioneers was convicted of this, as was one of our major ham convention luminaries. And so we naturally react with suspicion when we see ads aimed at attracting youngsters to a homosexual ham group.

And now we're learning that Catholic priests have been having sex

with and even raping altar boys without any significant reaction by the church when it's reported . . . other than to transfer the offenders to a new area . . . much to the frustration of the families involved.

The militant feminists haven't helped things. Men and women have some powerful basic differences, which many feminists try to deny. For instance, men, when they are born, are much less amenable to socialization than women. They're four to six weeks behind neurologically, and need more care. They're more likely to be hyperactive, autistic, color-blind, left-handed, and prone to learning disorders. They tend to be much more affected by the mother's prenatal use of drugs such as tobacco and alcohol. In every society men play more roughly, drive more recklessly, and fight more than women, and these traits appear early in life. Archaeology tells us that in prehistory about 25% of all males died in fights . . . about the same as anthropologists have found in recent years with primitive tribes.

Men, as they grow up, are much more likely than women to cause trouble in school, be alcoholics or drug addicts, and commit crimes. And by the way, there is no historical evidence to show that there's ever been a society ruled by women.

Just as the militant feminists are prone to name-calling, so are many of the militant homosexuals. They use the term "homophobic," yet no such phobia exists in any medical list of phobias.

This is demagoguery and makes as much sense as shouting back that they're women-phobic. It's McCarthyism repeating itself.

Judaism was a breakthrough religion in that it focused on the family. Its prohibition of non-marital sex changed the world. This was carried on later by Christianity. Both religions condemn homosexuality, incest, and bestiality.

If we look to Mother Nature as a guide, where one of her basic rules is to be fruitful, homosexuality fails. So I have no personal problem with consenting adults enjoying what pleases them as long as they don't mess with unconsenting adults or children.

Having served for four years in the Navy, I had a good laugh over the spot Clinton got himself into by catering to the militant gays and promising them out-of-the-closet military careers. Clinton, not having served in our military, didn't know what he was getting into. And sexuality being what it is, as anyone who's read much about our prisons knows, announced homosexuals in the military could easily create trouble.

I went to sea for five war patrols during WWII with a crew of about 80 other sailors. We were all men and good buddies. We still get together every year to remember the good and bad times we had 50 years ago. But if we'd had some gays sleeping right next to us in those crowded quarters, it could have created tremendous tension. And probably fights . . . something we sure didn't need on a submarine.

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AEA

AEA has recently introduced the IT-1 AutoTuner, an accessory for their popular IsoLoop 10-30HF antenna. The IsoLoop is a high-quality, high-efficiency antenna with a mere 35-inch diameter.

The IT-1 AutoTuner will automatical-

ly tune an IsoLoop in just a few seconds. When more control is necessary, there is a thumbwheel for manual tuning and fine adjustments.

The IT-1 AutoTuner features a 12-button keypad with an audible beep to announce completion of tuning. It has eight programmable memories as well as a 10-segment LED bar that monitors the tuning process and indicates the selected memory number. Memory backup and a built-in serial interface are also included.

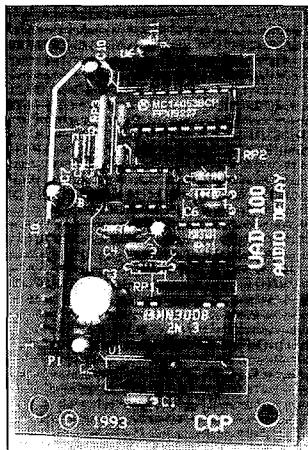
The suggested retail price is \$279 at your local amateur radio dealer. The unit comes with a one-year warranty. For more information contact: *Advanced Electronic Applications, P.O. Box C2160, Lynnwood WA 98036; (206) 774-5554, Fax: (206) 775-2340.* Or circle Reader Service No. 201.

CREATIVE CONTROL PRODUCTS

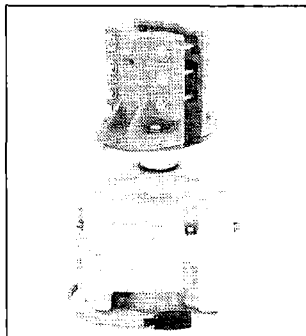
Here is a brand-new, low-cost, easy-to-interface repeater audio interface circuit from Creative Control Products. The UAD-100 Universal Audio Delay board features complete DTMF tone mute, and squelch tail elimination.

This board is inserted in the repeater receiver audio path before any audio switching circuitry. It then delays the audio before it arrives in the repeater transmitter, resulting in a pleasant-sounding transmitter drop. No more crashing, clunking, or snapping. Finally, a great sounding system, made easy.

The UAD-100 comes fully-assembled and tested, with a detailed application manual and one-year warranty, for \$99. For more information, please contact: *Creative Control Products,*



3185 Bunting Avenue, Grand Junction CO 81504; (303) 434-9405. Or circle Reader Service No. 203.



M²

The new Orion OR-2800 Antenna Rotator from M² is conservatively engineered for long life and reliability while turning large antennas or systems of up to 35 square feet of wind area. New features include a strong, ductile iron

mast clamp, large drive plate, improved drive shaft, and prop pitch style torque plate. The powerful motor and large heat-treated gears provide 2,500 inch pounds of torque. Vertical load capacity is 1,800 pounds. The unit can accommodate up to 3-inch o.d. masts and fits nicely with most popular towers and rotator plates.

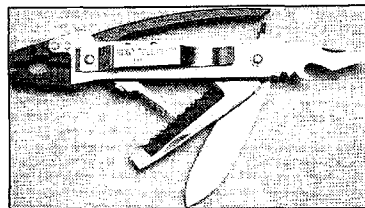
The RC2800 Control Box provides the finishing touch. It has digital readout, variable speed control, slow start, reverse delay, and memory protection. The optional RC2800P adds programmability, two-rotator control, AZ readout, and other features.

The OR-2800 Rotator is manufactured in the US by M² and carries a one-year warranty. The suggested retail price is \$1099. For more information, contact: *M², 7560 N. Del Mar Ave., Fresno CA 93711; (209) 432-8873, Fax: (209) 432-3059.* Or circle Reader Service No. 205.

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Wouldn't it be nice to always have an entire tool chest right at your fingertips? Well, now you can have the next best thing—the new SOG ToolClip from Jensen Tools, Inc. This unique pocket tool combines 13 functions in one neat little package.

The SOG ToolClip features a full-jaw pliers, a combination gripper and wire cutter that can easily handle chain-link fencing, a razor-sharp spear-point blade, a utility blade, a serrated-edge blade, a pair of screwdrivers, a pair of wire strippers, a file, a pry bar, and a bottle opener, all in a sturdy housing complete with a belt clip. The pliers, wire cutters, and grippers can all be accessed with only one



hand—a mighty helpful feature when climbing towers or holding materials.

The SOG ToolClip is constructed of durable stain-resistant steel and is guaranteed for life against defective workmanship and materials. The price is \$59.95. For more information, or to receive a free catalog, contact: *Jensen Tools Inc., 7815 S. 46th St., Phoenix AZ 85044; (602) 968-6231.* Or circle Reader Service No. 202.

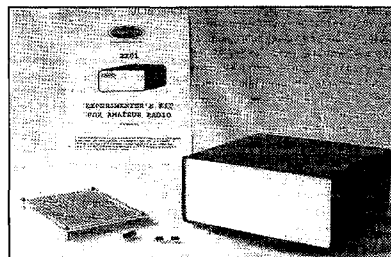
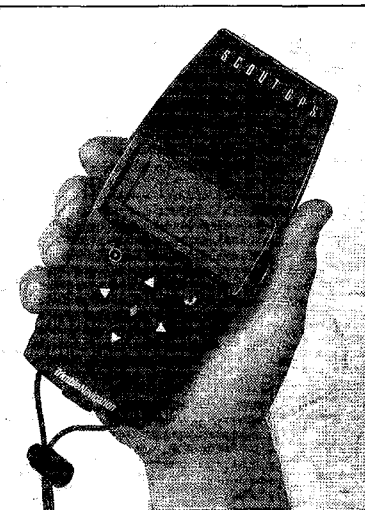
TRIMBLE NAVIGATION

You'll never get lost again with Trimble Navigation's satellite-based handheld GPS (Global Positioning System) Scout. It is perfect for amateur radio applications, search and rescue, backpacking, and off-road driving. The low-cost Scout GPS receives positioning data from 24 orbiting satellites to pinpoint your location around the clock, anywhere on earth, in any weather.

The GPS was designed and developed by the US Department of Defense to benefit both military and civilian users. Hams will enjoy the Scout GPS, which is based on the Maidenhead Grid Locator, displaying location information in language familiar to many amateurs. Scout uses the ARRL's grid square locator technique.

The Scout GPS kit contains four AA batteries, a user's manual, cordura carrying case, lanyard, and the Trimble Atlas. The whole package retails for \$795 and an external antenna

kit accessory is available for \$150. For more information contact: *Trimble Navigation, 645 North Mary Avenue, P.O. Box 3642, Sunnyvale CA 94088-3642; (408) 481-8000, Fax: (408) 730-2997.* Or circle Reader Service No. 204.



JADE PRODUCTS, INC.

Jade Products' Fun-Kit EK01 Experimenter Board provides a unique solution for the amateur radio builder. With this prototyping parts kit the novice and the seasoned experimenter can design numerous circuits. The kit contains a general purpose PC board engineered specifically for RF and other radio-type projects. Also included are three versatile ICs used in RF design, mounting hardware, a handsome 7.5" x 8.5" x 3.5" enclosure, complete assembly in-

structions, and building suggestions.

The 5" x 7" PC board consists of four general areas: a digital device area for active filters, keyers, logic, battery chargers, line drivers, etc.; an RF power area with 0.20" solder pads to mount discreet devices such as capacitors and inductors—ideal for QRP transmitter designs; a transistor device area with three footprints for circuits such as VFOs, buffers, and crystal oscillators; and a dedicated circuits area featuring the NE602AN mixer/oscillator chip, an audio amplifier circuit using the LM386, and etch support for the Motorola MC1496. The enclosure is finished in pleasing neutral colors.

The price is \$44.95. For further information, please contact: *Jade Products, Inc., P.O. Box 368, E. Hampstead NH 03826; (603) 329-6995.* Or circle Reader Service No. 206.

David Cassidy N1GPH

ARRL At It Again

Once again, I am forced to inform you of the sneaky goings on down in Newington. Like so many of their actions in the past, actions made on *your behalf*, you won't be reading about this in *QST*. I sure do wish I didn't have to keep doing this, but I feel that it is important the amateur radio community gets an accurate picture of the organization that supposedly represents all of us.

As you may remember, the FCC now has authorization to allow a private organization to administer the issuing of special club and military call signs. The rules state that any organization seeking the right to issue these special call signs must (among other requirements) be tax-exempt under the IRS educational designation and exist for the purpose of furthering the Amateur Radio Service, demonstrate that its membership constitutes at least 1% of FCC-licensed operators (that would be about 6,140, as of this writing), and process applications without regard to race, sex, religion, national origin or membership status in any particular organization. Pretty simple, right? Not according to the ARRL.

The ARRL (surprise, surprise) thinks they should be the *only* organization allowed to issue these call signs. They tried to get the law written in such a way that would exclude all other organizations, but their sneaky tactics were discovered in the nick of time by Fred Maia W5YI. Fred got the wording changed, much to the League's chagrin. Oh, you never read about that in *QST*? Must have been a computer error, because I'm sure the ARRL would have made every endeavor to inform their members of such an important issue.

The FCC received applications to issue club call signs from five organizations: the ARRL, W5YI-VEC (whose tax-exempt status has been accepted by the IRS, but a number has not yet been issued), the Quarter Century Wireless Association (remember, it was the QCWA who licked off the League by coming up with a simple, elegant and workable no-code proposal, which effectively killed the ARRL's convoluted and complex plan), the Southeastern Repeater Association and the National Amateur Radio Organization. On August 6 of this year the ARRL also filed a 24-page "Opposition to Requests for Designation of Certain Entities as Club and Military Recreation Station Call Sign Administrators." In this document, the ARRL objects to all four competing organizations' applications.

The League doesn't like W5YI-VEC because their tax-exempt status has not yet been issued. The League also objects to the fact that W5YI-VEC changed its corporate status from two divisions of the same company to two separate corporate entities, one of which is to be tax-exempt. I'm surprised that the ARRL used this flimsy objection, since it is similar to what they had to do, as publishers of license testing literature, when they wanted to start the ARRL-VEC (another time in the recent past when the

League tried and failed to block all other organizations from participation).

The ARRL doesn't like QCWA because it is a social club and, according to Newington, is organized for pleasure and recreation rather than education. The League also mentioned that it doubted the QCWA could handle the assignment of club call signs with a single employee.

The Southeastern Repeater Association is being blackballed by the boys in Connecticut because they filed their application by fax at a time when the FCC offices were closed for the evening. The League also states that a facsimile transmission does not constitute a legal signature, and that the SRA doesn't have the required 1% of all licensed amateurs as members.

The ARRL questions The National Amateur Radio Association's claimed membership of over 7,000 and its function as anything more than a very limited magazine publisher, subscription to which constitutes membership.

This move by the ARRL to block any other group from administering any part of amateur radio is not new. Time and time again, the League has spent your dollars to fight *their own* personal battles and agenda. Only when the League is successful do the members hear about how the all-knowing and benevolent ARRL has wrought something wonderful. When the League fails at their power grabs (as in the case of the VEC program and the authorization bill that started this call sign administration program), the members are never informed.

I have been accused of being a League-basher. This is simply not the case. Most of the people who I come in contact with who work for the League are great folks. Really! The problem is the folks in charge. Remember, the fish always stinks from the head down. I'm sure that all the folks at the upper echelons of the ARRL are nice, law-abiding people who are kind to small children and puppies, say "please" and "thank you" and always remember their mothers on Mother's Day. I do not question the personal qualities of any individual. The organization as a whole has lost its way. They have stopped looking out for the interests of amateur radio and are now only concerned with the interests of the ARRL. Unfortunately, they long ago convinced themselves that the two are the same thing.

The ARRL must be accountable to the very people it claims to serve. I don't think any criticism I've ever leveled at the League has been ungrounded. I've received a lot of mail about my opinion of the ARRL, but never once has anyone presented evidence to show that I was wrong. My deepest hope is that, with the passing of the old guard, a new generation of hams will rise forth to reclaim a once-proud heritage.

Until that day arrives, a simple question remains: Since the ARRL claims to be "of, by and for the radio amateur," how come so much of their time and your money is spent on fighting for control of amateur radio instead of solving the problems of amateur radio?

Jim Gray W1XL

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

In general, the month of October is expected to provide GOOD propagation. The chart shows POOR days on the 14th, and from the 17th through the 20th. The remainder of the month will provide days trending around FAIR in both directions. October exhibits the usual fall conditions; that is, on the 10, 12, 15, and 17 meter bands, you should find some excellent conditions for worldwide DX on the days of the month marked GOOD. In particular, the higher the band, the more frequent north-south path openings; and the lower the band of this group, the more frequently you will find east-west openings. The higher bands will peak in the afternoon, following the sun westward from your location. Twenty meters will be your best DX band, with dawn to dark openings to almost every area of the globe.

Signals won't be quite as strong as they were earlier, in the peak of Cycle 22, but they will be very acceptable. On 10, 12, and 17 meters, you will find occasional F2-layer openings and sporadic E-layer openings where signals can peak for as long as a half hour and then suddenly disappear as the electron "cloud" drifts out of the skip range. The lower HF bands of 30 and 40 meters will exhibit some slightly different behavior. They will be your evening and nighttime bands, with DX to your east toward Europe peaking around midnight, and to the west toward Asia and the Pacific in the early morning hours around local dawn.

Thirty meters will close earlier for within-U.S. short-skip, and you should be able to work DX at local dusk. High absorption during the daytime in summer always limits skip contacts, but this month the absorption will be less and good daytime skip signals should occur on the GOOD days, with high levels. As always, thunderstorm activity will cause QRN, but that problem is expected to be much less in evidence now as we move toward winter conditions.

On 80 meters, you will find some good DX from evening to

dawn, very often to the Southern Hemisphere, and good daytime short skip in the absence of thunderstorm activity. For you top-banders, 160 meters will be best for the hours of the evening, peaking for DX around midnight and again at dawn. Also, nighttime short skip openings will be excellent on the GOOD—and ever some FAIR—nights, out to about 2,000 miles or so.

As we've said before, keep your eyes and ears open on those days marked POOR, as other manifestations of a disturbed magnetic field may occur, such as hurricane-force winds, volcanic eruptions, "freak" weather, and even "quakes." Obviously, they won't always occur, even when they do, it is difficult to determine where they will occur. Pay particular attention to 19th and 25th, and to 1 day on either side of these dates. Let me know how the forecasts work for you. W1XU

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	-	-	-	-	-	-	-	-	-	-	-	-
ARGENTINA	-	-	-	-	-	-	-	-	-	-	-	-
AUSTRALIA	-	-	-	-	-	-	-	-	-	-	-	-
CANAL ZONE	-	-	-	-	-	-	-	-	-	-	-	-
ENGLAND	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII	-	-	-	-	-	-	-	-	-	-	-	-
INDIA	-	-	-	-	-	-	-	-	-	-	-	-
JAPAN	-	-	-	-	-	-	-	-	-	-	-	-
MEXICO	-	-	-	-	-	-	-	-	-	-	-	-
PHILIPPINES	-	-	-	-	-	-	-	-	-	-	-	-
PUERTO RICO	-	-	-	-	-	-	-	-	-	-	-	-
SOUTH AFRICA	-	-	-	-	-	-	-	-	-	-	-	-
U.S.S.R.	-	-	-	-	-	-	-	-	-	-	-	-
WEST COAST	-	-	-	-	-	-	-	-	-	-	-	-

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	-	-	-	-	-	-	-	-	-	-	-	-
ARGENTINA	-	-	-	-	-	-	-	-	-	-	-	-
AUSTRALIA	-	-	-	-	-	-	-	-	-	-	-	-
CANAL ZONE	-	-	-	-	-	-	-	-	-	-	-	-
ENGLAND	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII	-	-	-	-	-	-	-	-	-	-	-	-
INDIA	-	-	-	-	-	-	-	-	-	-	-	-
JAPAN	-	-	-	-	-	-	-	-	-	-	-	-
MEXICO	-	-	-	-	-	-	-	-	-	-	-	-
PHILIPPINES	-	-	-	-	-	-	-	-	-	-	-	-
PUERTO RICO	-	-	-	-	-	-	-	-	-	-	-	-
SOUTH AFRICA	-	-	-	-	-	-	-	-	-	-	-	-
U.S.S.R.	-	-	-	-	-	-	-	-	-	-	-	-

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	-	-	-	-	-	-	-	-	-	-	-	-
ARGENTINA	-	-	-	-	-	-	-	-	-	-	-	-
AUSTRALIA	-	-	-	-	-	-	-	-	-	-	-	-
CANAL ZONE	-	-	-	-	-	-	-	-	-	-	-	-
ENGLAND	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII	-	-	-	-	-	-	-	-	-	-	-	-
INDIA	-	-	-	-	-	-	-	-	-	-	-	-
JAPAN	-	-	-	-	-	-	-	-	-	-	-	-
MEXICO	-	-	-	-	-	-	-	-	-	-	-	-
PHILIPPINES	-	-	-	-	-	-	-	-	-	-	-	-
PUERTO RICO	-	-	-	-	-	-	-	-	-	-	-	-
SOUTH AFRICA	-	-	-	-	-	-	-	-	-	-	-	-
U.S.S.R.	-	-	-	-	-	-	-	-	-	-	-	-
EAST COAST	-	-	-	-	-	-	-	-	-	-	-	-

100 Meters possible on good days only

OCTOBER 1993

SUN	MON	TUE	WED	THU	FRI	SAT
					1 G	2 G
3 G	4 G	5 G-F	6 F	7 F	8 F	9 F
10 F-G	11 G	12 G-F	13 F-P	14 P	15 P-F	16 F-P
17 P	18 P	19 P	20 P	21 P-F	22 F	23 F
24 F-P	25 P	26 P-F	27 F	28 F-G	29 G	30 G
30 G						

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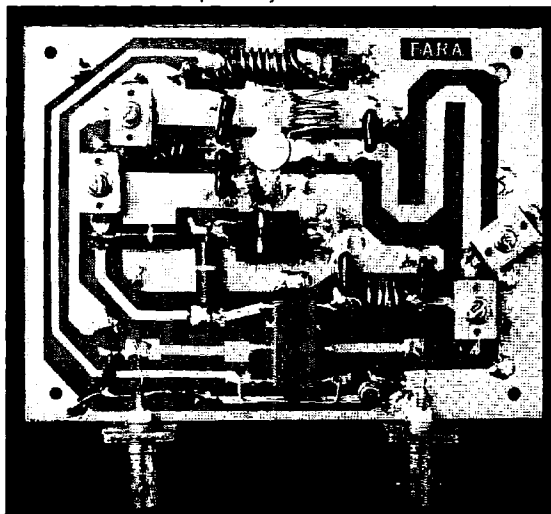
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On the cover: Senior Editor Charlie Warrington WA1RZW takes his 2 meter HT hiking in New Hampshire's autumn woods.
Photo by David Cassidy N1GPH.

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Contract: If you can read this fine print, you are hereby legally bound to fulfill your obligation to the future of ham radio. You are ordered to seek out a bright, young mind and turn it on to our exciting hobby. Be an Elmer. (Of course, to start your student off on the right foot, make sure he or she has subscriptions to 73 and Radio Fun).

NEVER SAY DIE

Wayne Green W2NSD/1



Amateur Radio Frontiers

There are still plenty of frontiers for the adventurous ham to explore and pioneer. Everything hasn't been invented, by a long shot. Indeed, there are tons of articles I'd love to see published in 73, if only you'd write 'em.

For instance, I've seen pitiful little in recent years on slow-scan developments. We need to (a) digitize slow-scan so we can send some really detailed full-color pictures, and (b) use modern compression technology to keep the bandwidth down. When's the last time you saw any articles on things like this? What do you need to get your mind working and your fingers busy? With the progress we've had in slow-scan technology in the last few years, any interested ham with totally zero technical knowledge and a will could have come from zero to being the top expert in the field. All it takes is some interest and the determination to overcome obstacles.

When I first got interested in RTTY I knew zilch. But I was fascinated, so I read everything I could find . . . which wasn't much. I hounded the only expert in the field I knew, John Williams W2BFD. I built my own equipment using John's designs, a Model 12 Teletype machine he got for me, and got on the air. Wow, what fun! This was when I first learned about digitally encoding information and the ability of frequency-shift keying to get through interference far better than off-on (CW) keying.

Teletype used a five-bit code, which meant that there were just 32 possible combinations of zeroes and ones, or marks and spaces, as we called them. This is why telegrams and news Teletypes all used to print in upper-case letters. We didn't have any lower case. We even had to shift to handle numbers and punctuation. This is why ASCII code, which all computers use today, has eight bits. This allows 256 combinations of zeroes and ones, giving us far more flexibility.

When I couldn't get anyone to put out a newsletter to help us pioneers learn more about RTTY I finally gave up and did it myself. Indeed, that's what got me into the publishing business. I called it *Amateur Radio Frontiers*, and that was back in 1951. I wrote it, drafted the schematics, sold

the advertising, took the photos, set the type, pasted it up, handled the subscriptions . . . everything. It was incredibly valuable experience, and it changed my life.

Digital Compression Systems

With modern microcomputers it's relatively easy to digitize pictures. You can feed 'em into your computer from a home video camera or a scanner. But a decent picture can take a megabyte or more of memory, which is why we haven't been seeing much in the way of live video digitized yet. At 30 megabytes per second, that eats up a whale of a lot of memory in a hurry, no matter what you're using for storage.

So, the engineers have been working to compress the data, using various approaches (algorithms). The International Standards Organization's Joint Photographic Experts Group (JPEG) uses a discrete cosine transform which compresses files by 90-95%, giving us ratios of 10:1 to 20:1. Iterated Systems of Norcross, GA, went the fractal route and has been able to compress data around 75:1.

Fractals? If you haven't messed with these babies you've missed a whole new world of math and beauty. IBM's Mandelbrot got interested in chaos theory a decade ago and discovered that seemingly chaotic systems produced similar patterns when plotted. He called the resulting patterns fractals. Computer owners with color displays can generate these beautiful patterns. If you aren't familiar with fractals and chaos theory, you're letting the real world get away from you. As hams, you're supposed to be up on science and electronics. You're not flying under false colors, are you?

So, let's see some articles on digitized slow-scan pictures. Let's see some articles on the theory and practice of compression techniques. And, let's see some protocols for digital slow-scan.

If we can at least send our American standard video picture quality (NTSC) by digital slow-scan, then we can start working on ways to move to high definition slow-scan. One step at a time. More and more of us are buying high definition color monitors for our computers, so we've got the mak-

ings of some wonderful slow-scan pictures.

You may not be an expert on digital video now, but by next year are you going to be even further behind? Or will you be one of the people writing the articles? When I got started publishing my RTTY newsletter it didn't take long before I knew what I was doing. A few years later I published the first book on ham RTTY. In the meanwhile my columns in *CQ* helped get thousands of hams involved with this fun part of the hobby.

Digitized Voice?

With all broadcast radio going digital, as well as TV, we hams better start thinking in digital terms or we're going to be as far out of date as if we were still using spark gaps for our CW. Yes, I know, many old-timers are still upset over having to change to sideband 30 years ago. I think all of the "spark forever" crowd have finally won their Silent Keys certificates, though they were still a grumbling, resentful bunch when I started hamming in the 1930s.

With digital broadcast test stations showing three times the signal coverage with a hundredth of the power . . . plus the ability for six different stations to share each channel . . . digital is definitely coming. Sideband gave us six times the bang for the buck over AM, plus it allowed more stations per kHz. It certainly met the rule of thumb criterion for a new technology to be 10 times better than the old in order to survive. Well, so does digital, so nothing can stop it.

With that in mind I'd like to see some special temporary authority (STA) hams experimenting, complete with articles for 73.

Data Compacting

In addition to the usual search for compressing algorithms, we might start setting up some protocols for packet and RTTY which would compress our transmissions. This doesn't even have to be high-tech. CW ops invented the Q-code to shorten their transmissions. So how about some simple look-up tables our computers can use to cut down on redundant messages? A sort of packet approach to the Q-code? For instance, "N>" might translate into "the name here is."

We could even simplify names a bit with "Bob" being "bb" and "Bill" being "bl," Wayne being "wn," and so on. That would speed up the more common names.

With data compression we should be able to get contacts down to a few seconds of air time. "rv" could mean "the rig here is an ICOM 735." The second character could indicate up to 256 different models of rigs. Ditto for antennas. Yes, "q" would mean "I faithfully promise to send you a QSL card for this wonderful contact and hope that you will send one in return." A "w" with one added character would indicate up to 256 different kinds of weather, thus slicing at least two to three minutes of air time from every contact.

In this way we'll be able to make several contacts a minute and then read the expanded copy later when we have time. Few of us bother to comment on anything the other chap is saying anyway, so what's lost? The only really significant element of the contact is making sure you have the call right. You've got the *Callbook* on a CD-ROM, so you don't really need a location, unless he's portable.

With data compression we'll be well on our way toward completely automatic contacts. We'll be able to get reports from our computer on who we've contacted while we're at work or sleeping. Or watching ball games or TV. I'm reminded of RTTY back in 1950 when I'd come home from work and pick up 50 feet or so of printout and read what'd been talked about or the RTTY channel all day.

If we do find something of common interest we can send prewritten documents from our computers. In the old days we'd punch Teletype tape with stories we might want to repeat. When there was an interest in some subject we'd load the tapes into the reader and they'd zip through at 60 wpm. It's a little easier today.

Oops, We Lost 100,000 Hams!

Just when we were all getting our arms out of joint congratulating ourselves on boosting our numbers to 600,000 licensed hams (FCC count) we get the bad news that the ARRL has done a survey and found that 16% of us are missing. Holy jumping Morse code, that's a hundred thou, piff! How'd that happen?

Well, as I've been reminding you and you've been ignoring, the FCC no longer bothers to delete our Silent Key award winners, nor our bored or unemployed dropouts. And with our licenses now good for 10 years, there's a lot of buried ham in the *Callbook*. Tons.

So, even with the increased input or no-code hams, are we breaking even? Maybe, just.

In looking over the ARRL survey, it seems like we have an awful lot of old-timers with a serious death wish for our hobby. I can't spread a lot of guilt on you because the chaps who are the problem don't read 73. Most of them hate it.

Continued on page 76

From The Hamshack

Dick Beaton N7RB, Helena MT Wayne—As an old CW op, I'm not going to jump in and tell you that we have to keep all those CW frequencies or that CW is sacred. As a useful means of communication, it is a real dud. It's fun if you like it. It is hard to believe the ARRL still promotes traffic handling on phone and CW when packet will do it better and faster.

I was licensed in 1934 and worked as a CW operator in the CCC camps in North Dakota. Would you believe I lumished my own home-brew station? It was that job that helped me get a job with Northwest Airlines, first as a radio operator in '38, and later as a station manager in '42. We even used CW for handling reservation traffic from 1939 until about 1944! Before that it was all AM phone!

Well, anyway, I was one of the first around here to promote the no-code license idea. I've also been promoting your method of learning the code. I've taught code off and on for years and was one of the first VEs around here; also among the first on packet. At least in my case CW hasn't scrambled my brains and I could easily prove it. I don't get on as much anymore as most guys just won't talk. And I'm with you on QSLs! If a DX station gives me that old "QSL via a bureau," I just tell him "no QSL needed." They used to come with neat stamps on them. Now they are just another card in the drawer. (How about using packet for QSLs and making an excuse for sending traffic?) I don't even know how many countries I've worked and could care less. It isn't a big deal anymore. I do have WAS on Geritol net 3767 kHz. The only thing on my wall is a Kenwood world map and my "Ham of the Year" plaque from the local club.

One thing you could quit harping on is DXpeditions. The real truth is that very few of the hams I know could afford such a thing. Your background gets you into places that are out of reach to most others, so please quit comparing yourself with the rest of the hams. You are one of the privileged elite. As a VE, I know that some people have a tough time coming up with five bucks. I know how it is because I was one of them. You weren't.

When I was a kid we used to get the battery out of our Whippet to light the filaments in the old four-tube regenerative radio with a horn speaker. The problem was we went without radio a lot because the "B" battery didn't last very long. I set out to "invent" a substitute without spending any money because I didn't have any and my dad was on WPA. I succeeded, too! I didn't exactly know for sure what I was doing, but I ended up using a doorbell transformer to light the 201-A filament. I used one side of an audio transformer for a choke and the capacitor out of a Model T Ford coil for a filter. The plate and grid were tied together to make a diode that rectified the 110 AC. It worked like a charm.

After WWII I went through a lot of surplus gear modifications, etc. I never had an AM rig, just home-brew CW until the HW-101.

The mess on 14.313 makes me ashamed, but I have resisted the temptation to jump in and tell them off. It must be the big amplifiers those guys use that screws up their brains. I don't think the Extra Class license did it. I've got an amplifier, but haven't had it hooked up for a long time. Those old dudes who do talk don't have anything good to say, anyway. I used to check into the QCWA net in Montana and all those old guys do is talk about their health complaints and the weather.

Incidentally, you wanted to know what new products we use. Well, I had an R-5 vertical which worked great but was limited to bands higher than 40 meters, so I sold it and bought a GAP. It works fine, too, but on 80 the low angle of radiation makes it useless for visiting with guys within 100 miles or so. I tried to put a Biall in the attic here without any success. Our attic goes up through a hole in the hall closet, so I had to give up trying to make it work. It doesn't even look like it should work!

I'm 76 years old and sorry I'm going to miss all the wonderful new things just over the horizon. Then again... I've lived to see one helluva revolution in the world of scientific knowledge. I missed a lot because I went to the college of hard knocks, but I think I know a lot more than quite a few college grads who never learned anything very useful.

One last thing: Hope you succeed in getting the school system fixed. Everyone should know Ohm's Law and DOS.

73 to a great editor. You and Rush Limbaugh should get together! You have a lot in common.

Dick—Elite? Me? Har-de-har. I've never been on a DXpedition that cost much. Travel is mostly a matter of decision. It doesn't have to cost a lot. For instance, Sherry and I spent a week in Rome last month. Wow, that must have cost a bundle! Well, we flew business class, stayed in a very nice hotel, went everywhere, saw everything, had some great dinners. Now how much would you budget for a trip like that, total?

The flight, hotel, meals, taxis, tips, and everything for a week came in at \$551. A couple years ago we flew round-trip to Munich business class, rented a car, drove to Vienna, Krakow, Prague, and back to Munich. First class hotels. Fine meals. Two weeks. The total cost was under \$1,000.

Of course I was able to do some business on each trip, which more than paid the cost of the trip. In Vienna I signed a contract with an Italian publisher to use 73 articles. In Rome I made import agreements with two record companies. Travel doesn't have to be expensive if you do it right. And that includes DXpeditions.

How much does it cost to drive to Halifax? Peanuts. Then there's the short flight to St. Pierre. The hotel was ridiculously inexpensive. So were fabulous meals. So we DXed there for a few days.

Any ham who has trouble coming up with \$5 sure isn't much of an entrepreneur... and isn't using his ham know-how for anything but his own fun. There are too many easy ways to make money these days for anyone to be poor... unless they've been too lazy to get an education. Maybe you've noticed that there are very, very few well-educated poor people... and very few poorly-educated rich people. It's almost enough to make someone think.

College is a waste of time, no matter what you want to do. You can learn 10 times as much in half the time on your own. But then you want to keep right on and not stop. I'm still learning. I've read over 100 books in the last few months and have 50 more by my bed being read. No fiction... Wayne

Matt Thomas N8TWF, Ortonville MI I am writing to you because a few hams have really made me sick. I was scanning the 20 meter band not too long ago and heard a small group of hams cursing and swearing like mad on 14.315 MHz. What kind of representation of our great hobby is this? If I were a shortwave listener thinking of getting a license, this would probably convince me to change my mind. The only place I have heard more cursing is at school. I thought hams were to promote international good will. In my opinion, this hardly promotes international good will.

By the way, I really enjoy reading "Never Say Die." Wayne, you have some interesting opinions.

John R. Lowther, II, Lawrence KS I am writing in response to your "Never Say Die" column in the June 1993 issue. I have been a sporadic reader of 73 for years and your column is often the most interesting part of the magazine and certainly the most unpredictable.

In this column you hammered on one of the problems which has been keeping me from seriously pursuing an amateur radio license: There seems to be hardly anyone out there worth talking to. When I listen on the ham bands with my little Sony 2010 I find very little worth listening to. Using the receiver section of my elderly Drake TR-4C I find nothing more, despite its superior ability to separate one signal from the next.

I went through a study guide for the no-code Technician license and was surprised to find that the so-called "significant technical requirement" consists mostly of extremely basic electronic theory that anyone who has actually done anything with electronics should already know.

Of course, the no-code Technician license is not all that interesting, lacking privileges on the HF bands capable of reasonable reliable long-range contacts. Even with the addition of passing the 5 wpm Morse code test, only the 10 meter band is available for telephony, the other bands allowing only digital communications (including that most primitive of digital systems, CW).

If the ARRL cannot be pried away from the old incentive licensing scheme, perhaps the privileges for using manually-generated Morse code can be separated from the other privileges of the license so that having once passed the 5 wpm code test (3 wpm would be better), to meet the re-

quirement of the treaty, you would gain all of the General Class privileges upon passing the General Class written test, except on frequencies designated for emission type A1A, only gaining A1A privileges on passing the 13 wpm code test, and likewise to the Advanced and Extra Classes.

This proposal would be consistent with the objective of the amateur radio service as a source for skilled electronics technicians, as it would provide rewards for gaining additional technical knowledge without holding the acknowledgment of their advance in knowledge hostage to skill in using an obsolescent (and I am tempted to say obsolete) communications technique.

Eric P. Nichols KL7AJ, North Pole AK Here's an interesting figure for you. I recently acquired an HF packet station (actually a by-product of the AMTOR station I wanted). At any rate, I opened up all the AX25 monitors and tuned to the 14.103 MHz PacketCluster, letting everything spill its guts out of my page printer. After a six-hour period, I did some statistics on the printout. Lo and behold, 98.4 percent of all printed matter was "overheard," i.e. addressing an error-correcting information. The remaining 0.6% of the printed matter was actual text. So, the point is that inutilities are not restricted to phone bands, they are built into the very soul of packet radio! A little food for thought!

One nice thing about packet, though, is that I can selectively reject calls from such unwanted areas as Japan. I call my program my "JA notch," and it saves a whole lot of wasted time and effort. Back in my phone days I used to call "CO nc JAs," but someone told me that was uncouth. Packet allows me to be selectively rude (or rudely selective) with no guilt!

Mind you, I have nothing against Japan per se, but if you have ever operated in Alaska you will know that JAs are about all you can get without extensive maneuvering... they literally swarm the high bands. Most KL7s rely on vast quantities of front-to-back ratio to solve the problem, but that leaves something to be desired in case you want some desired Asian country!

By the way, I have devised a new more efficient signal reporting system one in which the typical QSO is contained within the report itself. The report has two numerals and two letters. A typical QSO might be like this:

"AL7HC, this is KL7AJ. Your report is 59YR."

"KL7AJ, this is AL7HC. Yer' report is 57IS. 73s."

"73s. KL7AJ clear."

Translation: "AL7HC, this is KL7AJ, you're five by nine, the rig here is a Yaesu, and the weather is rainy."

"KL7AJ, this is AL7HC. Roger. Yer' five by seven, the rig is an ICOM, and the weather is sunny. 73s."

"73s. KL7AJ clear."

As you can clearly see, this four-character report is more than adequate for more than 98.4% of all amateur QSOs. For the long-winded, a third letter might be used to describe the current physical ailment: "H" for heart problems; "K" for kidney stones; "P" for prostate surgery, etc.

RF Radiation Feedback

The FCC has extended the comment period on a proposal (in E.T. docket 93-62) that the commission adopt new guidelines for evaluating the environmental effects of radio frequency radiation. The federal agency will hear comments until November 13 on the proposed guidelines, which are the same as those already adopted by the American National Standards Institute and the IEEE.

The FCC says the request for extension was made by the National Association of Broadcasters, and was supported by other interested parties. The NAB's request was to allow a study to develop non-measurement-based techniques for complying with the Commission's new rules. *TNX Westlink Report No. 656, September 1, 1993.*

Vanity Callsigns Authorized

Both the House and Senate have approved legislation authorizing the FCC to issue unique amateur radio callsigns, at a cost of \$7 per year, to the ham community. The surprise measure was inserted into the recently-signed deficit reduction bill of President Clinton.

According to a congressional aid close to the plan, "We envision that the legislation will probably be implemented so that an amateur pays \$35 every five years, although there is no language in the bill that says they have to do it that way. It only says they have the authority because they do not have this authority right now. . . . As I understand it, the proceeds will go to the FCC to augment their budget, . . . pay for equipment, staff, and stuff." The only amateurs who would be subject to the new fees are those requesting special, distinctive callsigns.

Another little-known tack-on to the deficit plan provides for spectrum auctions. The government is set to receive more than \$10 billion over the next five years when it sells radio spectrum to the highest bidder for new communications services. *TNX W5YI Report, Issue 16, August 15, 1993.*

Instant Ham

A petition has been filed before the FCC by the Western Carolina Amateur Radio Society VEC that seeks a rules change permitting instant ham radio licensing. Specifically, the Knoxville-based testing group wants the commission to amend Part 97 to allow amateur radio operating privileges to commence upon passing the required exam, without having to wait for the issuance of a first license.

The WCARS VEC argument states that anyone who holds a valid Certificate of Successful Completion for an amateur operator's license which was issued within a year should be authorized with the rights and privileges for that license class. They propose a temporary callsign structure based on the Class D citi-

zen's radio service precedent which was set several years ago under deregulation. Proponents believe this measure would save the government time and money they spend answering phone calls from those waiting for their licenses to arrive.

This proposal, designated as RM-8288 is open for comments to the FCC. *TNX Westlink Report No. 656, September 1, 1993.*

Codeless Coast Guard

For the first time since 1924, the United States Coast Guard has closed down its Morse code operations on 500 kHz. The final CW transmission ended an era at 000Z, July 31, 1993. Coast Guard radio operators first began listening for distress signals on 500 kHz at the turn of the century, and set up its permanent station nearly 70 years ago to monitor the frequency continuously.

Officials say the advent of satellite and digital technology has made Morse code obsolete on the high seas. A misty-eyed Coast Guard radioman tapped out the final 73, saying "We now look forward to serving you on the next generation of communications equipment and systems via the Global Marine Distress and Safety System (GMDSS)." *TNX W5YI Report, Issue 16, August 15, 1993.*

Lunar Repeater

Northern California's Project OSCAR group has proposed installing the first repeater on the moon. Project OSCAR is the group that built and orbited the world's first amateur radio satellite. During recent meetings, the organization has decided to revive "Project Moonray" to take amateur radio into the 21st century.

Moonray is short for Moon Relay, a concept first proposed by W6OLO back in 1965. The idea was to build a repeater that would fit under the seat of the Lunar Rover. But, the project was shelved after Congress cut funding for manned moon missions beyond Apollo 17.

No specific timetable has been offered, although organizers hope to get the project off the ground by the turn of the century—which is only six years and a few months away. *TNX Westlink Report No. 655, August 13, 1993.*

Going Commercial?

We're not talking about the relaxed business communications rules which took effect in September. We're talking about Commercial Radio Operator License examinations. If you've been thinking about sitting for one of these exams, now may be your best chance.

While it may not be common knowledge, many of the questions for the General Radiotelephone Operator License examination are taken verbatim from the Amateur Ad-

vanced and Amateur Extra Class question pools. Those questions are expected to remain in the pool, at least through the summer of 1994—and possibly beyond.

A GROL is required to adjust, maintain, or internally repair transmitters in the aviation, maritime, and international fixed public radio services. The General Radiotelephone Operator License replaced the old First and Second Class Radiotelephone licences back in 1984. It is issued for the lifetime of the holder. *TNX W5YI Report, Issue 17, September 1, 1993.*

Chile Bird

The first Microsat of Chile, named *CEsar-1*, is slated for launch in early 1995, according to the Radio Club Federation in Santiago. The organization will control the new satellite, once it is in orbit.

The Microsat class bird will orbit at an altitude of 900 km. The Radio Club Federation says *CEsar-1* will boost communication between local amateurs and the rest of the world. *TNX Westlink Report No. 656, September 1, 1993.*

Island Quake Mobilizes Hams


The strongest earthquake to shake the world in more than four years rocked the island of Guam on August 8. The temblor struck early Sunday morning, measuring 8.1 on the Richter scale.

More than 130,000 island residents were left without electricity and at least 40 people were injured. Tourists fled from hotels where structural cracks were seen and bridges also suffered damage.

Communication with the northern part of the island became critical due to knocked-out telephone lines and the need for emergency services. Amateur radio and MARS stations were utilized to carry information to and from the disaster area.

Guam is west of the International Date Line, 3,800 miles west of Hawaii, and 1,500 miles south of Japan. There were no reports of injuries or damage at the US military facilities on the 30-mile-long island. *TNX Westlink Report No. 656, September 1, 1993.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at 73 Magazine, Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 924-9343 (300-2400 baud, 8 data bits, no parity, one stop bit). News items that don't make it into 73 are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327. 

The FARA Project

An economical, easy-to-build, 25 watt 2 meter amplifier.

by James R. Valdes WA1GPO

The Falmouth (Massachusetts) Amateur Radio Association (FARA) is well-known on Cape Cod for its hospitality to newcomers. It is also one of the more active groups in Southeastern Massachusetts supporting two repeaters and a digital Node/LAN. One subgroup of the association is the HACKERS, a group of amateurs who enjoy designing and building their own equipment. When the HACKERS noted that a majority of the new members joining FARA were using 2 meter HTs, we recognized that we might entice some of these new hams into joining this select group of builders by helping them construct a power amplifier for 2 meters. We did this as a group project: Those with tools drilled the holes and those without cleaned and prepped the circuit boards for fabrication or wound the inductors. Those who had experience building gear Elmered those who didn't. All of the participants contributed to the success of this project.

This article describes a 2 meter amplifier capable of running 25-30 watts output. More than 35 amplifiers have been procured at a

cost of less than \$50 each in these quantities.

Photo A shows the final version of the circuit board; the completed amplifier is shown in Photo B. It is designed around one of the newer bipolar RF devices from Motorola, an MRF1946A (Q1). This device compares favorably with many of the RF FETs available as the MRF1946 is capable of developing 10 dB gain at 146 MHz, while the older bipolar devices (the 2N6080 series) produce only about 5.7 dB gain. RF FETs are generally rated at 13 dB gain at 28 volts; in the 12-14 volt range they also yield about 10 dB. The design presented here is unconditionally stable, while FET amplifiers require a bias supply and careful tuning at the higher voltages to maintain stability. The cost of the MRF1946A is only about two-thirds that of the FETs, yielding the most "Bang for the Buck!"

Circuit Description

Motorola produced an application note (RF Device Data, Application AN955) for a 150 mW to 30 watt land mobile VHF amplifier in the 160 MHz range, based on the MRF1946.

This was the starting point for this design.

The schematic diagram is shown in Figure 1. DC voltage into the amplifier is decoupled by C2, C3, L1, C4, C5, and L2. D2 is the reverse polarity protection diode—if the voltage is inadvertently reversed, D2 will limit the reverse voltage to 0.7 volts and fuse F1 will open, protecting the amplifier. The output stripline (Z1) described in the application note was lengthened for operation at 146 MHz and the output capacitor (C10) was empirically adjusted to yield an efficiency in the 70% range, just about what one would expect of a Class-C amplifier. The input circuit was derived from the formulas given in the *RSGB VHF/UHF Manual*. This manual is highly recommended for those interested in VHF/UHF construction. Similar examples of impedance calculations can be found in several editions of *The Radio Amateur's Handbook*. This approach was intended to demonstrate the microstrip vs. lumped constant techniques for impedance matching as one of the more subtle objectives of the HACKERS group is to provide some informal education on radio construction and

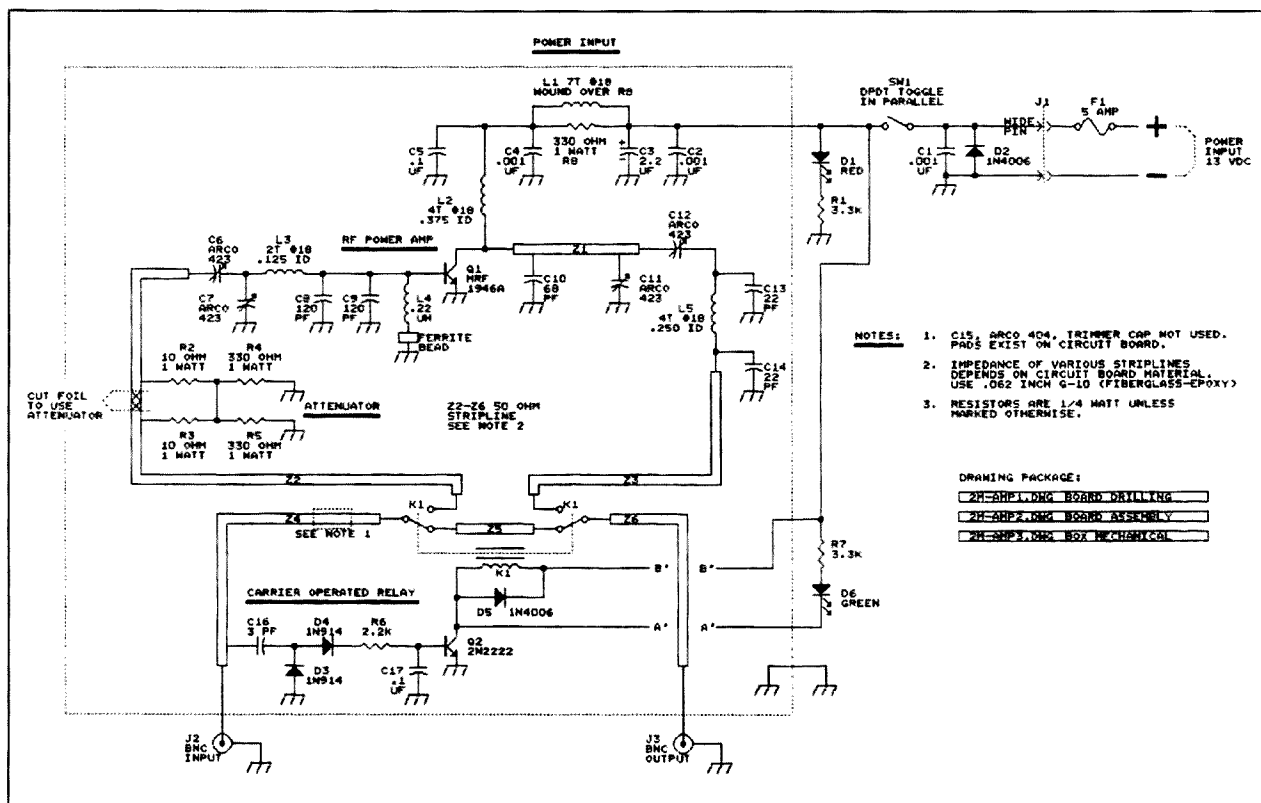


Figure 1. Schematic diagram.

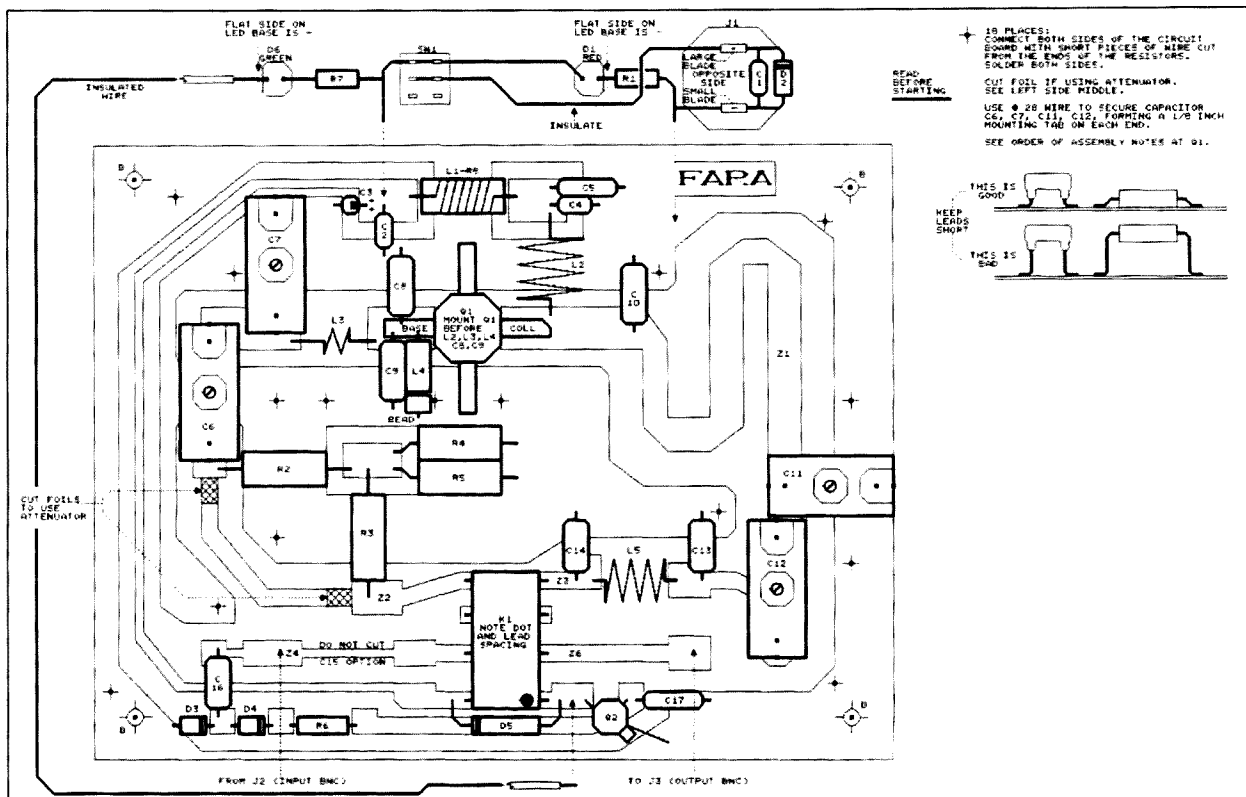


Figure 2. Parts placement diagram.

design practices. A low-pass filter network (C13,C14,L5) is in series with the output to enhance harmonic rejection.

Incorporated into the design is a resistive input attenuator network (R2,R3,R4,R5). The RF power transistor (Q1) is intended to be

driven with 2 to 3 watts input; higher drive levels will not increase the output substantially. Most of the older HTs can drive the amplifier directly, but the new breed of high power, 4 to 7 watt HTs will require the input attenuator. When the attenuator is used, the 50 ohm

microstrip must be isolated at the 10 ohm resistors. Cut the circuit foil at the locations noted on the parts placement diagram, Figure 2. The attenuator represents a nominal 3 dB loss; that is, half of the power is dissipated in the network. In addition to limiting the drive power to a safe level, the attenuator also enhances the stability of the amplifier by isolating the amplifier from the driver. It also presents a nominal 50 ohm resistive load to both units. If the attenuator is not required, the network consisting of resistors R2,R3,R4,R5 should be omitted.

An RF-actuated T/R relay (K1) has been incorporated into the amplifier. RF on the input is sampled by C16, rectified and limited by D3, D4, R6, and C17 to turn on Q2, which pulls in the relay. We considered using solid-state T/R switching. However, relay switching has the advantage that the amplifier can be turned off when it is not required. Conversely, diode-switched amplifiers must be powered at all times. This is in keeping with the spirit of the FCC regulations that require radio amateurs to use "the minimum power necessary to carry out the desired communications." Relay switching also results in a more compact, easier-to-duplicate amplifier. The relay specified in the Parts List is a small, open-frame style. Its performance is adequate for 2 meters.

Should you be a "purist," you can compensate for the inductance of the relay by installing a variable capacitor (C15) in series with the input to the relay, as noted on the parts placement diagram. This capacitor was

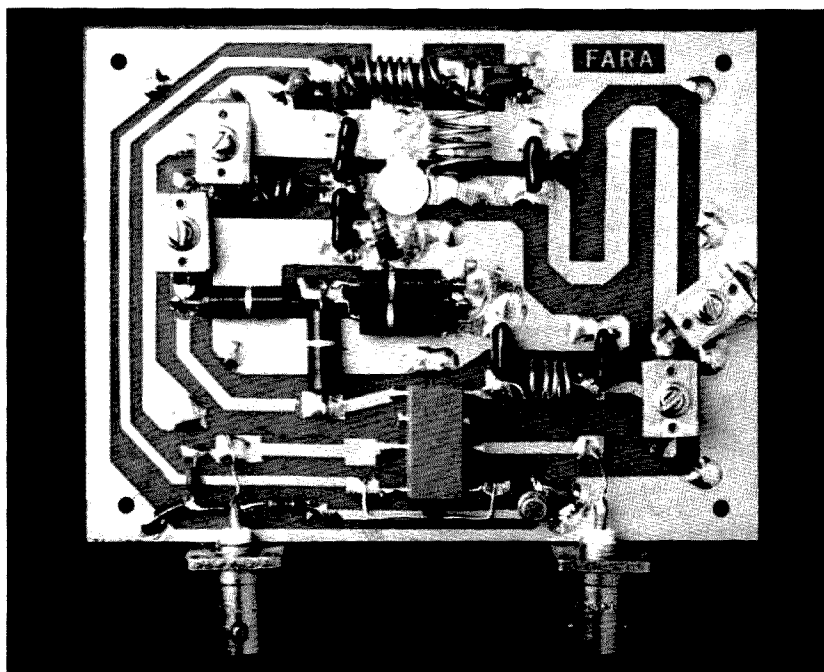


Photo A. Printed circuit assembly.

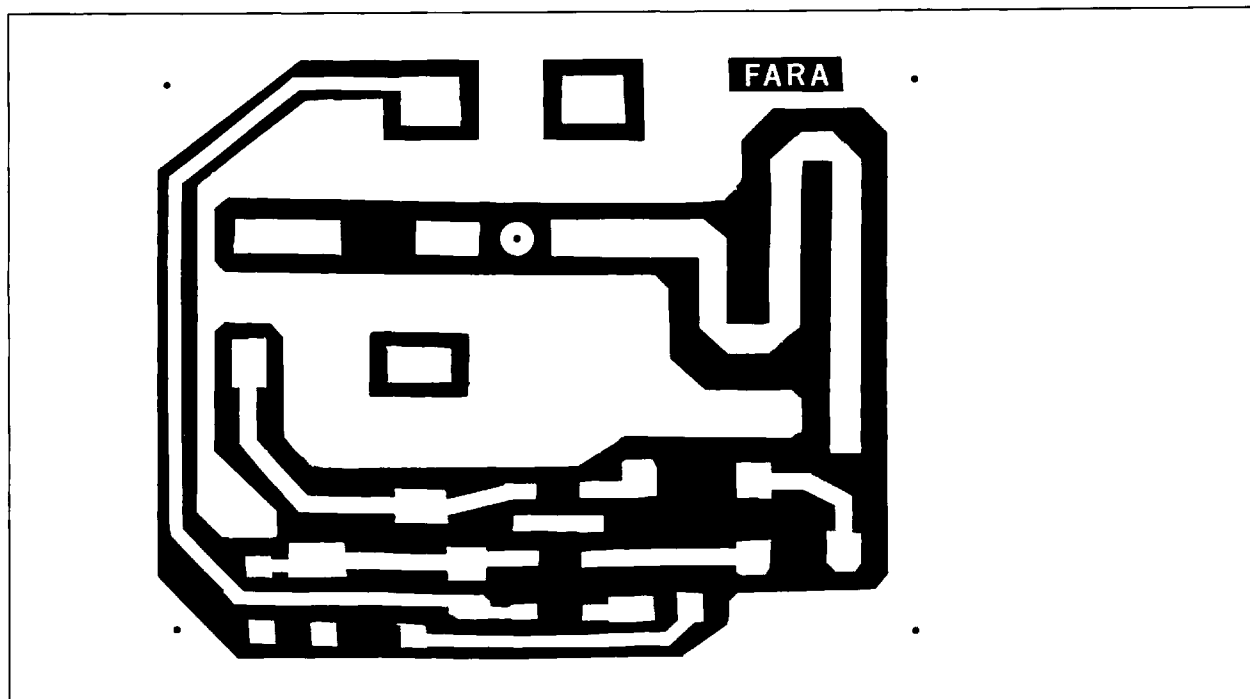


Figure 3. Printed circuit foil pattern (component side). Metal is shown in white, black areas are the etched surfaces.

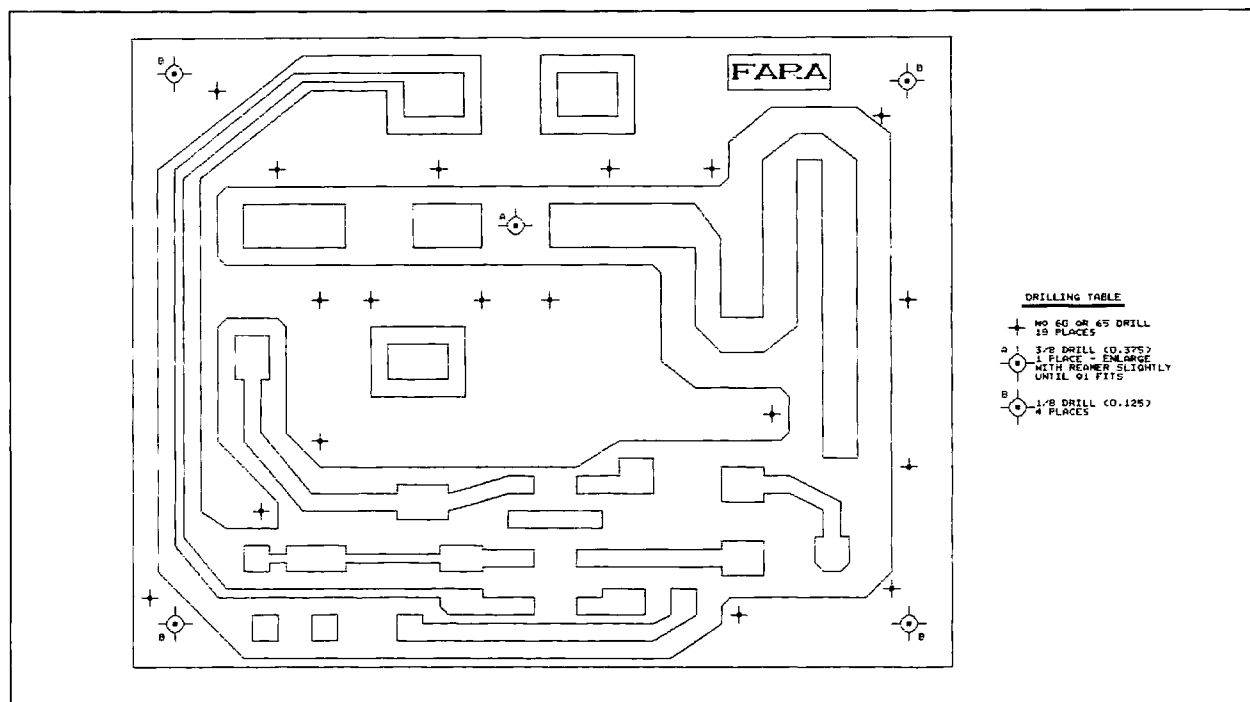


Figure 4. Drilling template.

not used on our production run. All of the input and output foil runs are constructed of 50 ohm microstrip (Z2-Z6) etched into the circuit board. The circuit can be modified for solid-state T/R switching. A PIN Diode T/R switch may be a better choice for packet operations, which require high speed switching. Several articles (including "A 2 Meter FET Amplifier for Your Handheld" by John Cunningham AA4AW, 73 *Amateur Radio Today*,

Oct. 1992, p.20) and the ARRL handbooks contain examples of diode switching.

A word of caution concerning the circuit board. It must be constructed of 1/16", double-sided, G-10 glass-epoxy board with 2 or 3 oz. copper. A full-size negative for the circuit board is provided (see Figure 3). The side of the board opposite the stripline remains a solid copper ground plane as it is not etched. Failure to reproduce the board exactly as

shown, with the materials specified, will dramatically affect the performance of the amplifier because the dimensions for the striplines are critical.

Low impedance grounds are crucial to the operation of the amplifier. A number of holes (18) must be drilled through the board (see Figure 4). No. 20 wire is inserted through these holes and soldered to electrically tie both sides of the circuit board together at the

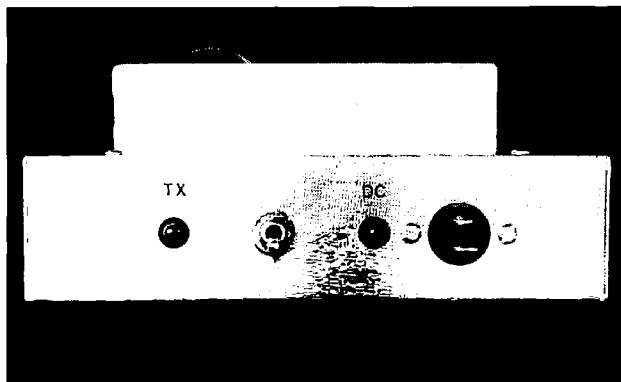


Photo B. Completed amplifier.

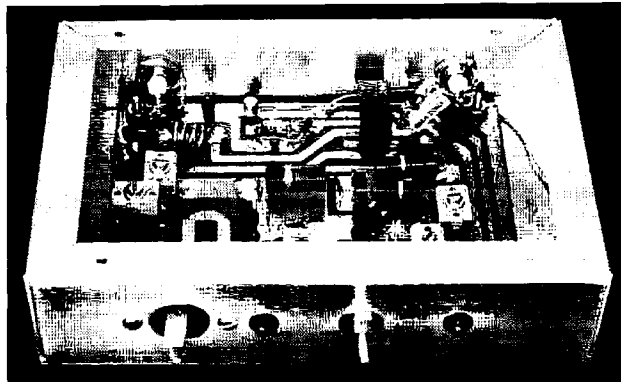


Photo C. Interior chassis view.

points indicated. Some flux may enhance the solderability on the ground plane side of the circuit board. Be sure to use only rosin core-solder!

Construction

Photo C is a view of the amplifier mounted in the suggested enclosure; it should be noted that the circuit board shown in this view is one of the earlier prototypes. It's a good idea to use the circuit board as a template to mark the case for the mounting holes before soldering the components to the board.

The MRF1946A utilizes an 8-32 stud for the heat sink and mounts with a single hole through the circuit board. Take care when mounting the device to insure that no strain is placed on the transistor's leads when it is sol-

dered. It must fit flush on the circuit board. A little thermal heat-sink compound on the flange of the transistor mounting stud is recommended to maximize heat transfer. Careful—don't get this stuff on your clothes because you'll never get it off! The circuit board mounts to the case with 4-40 hardware. Use 4-40 nuts under the circuit board corners to space the transistor mounting stud correctly. The heat sink (aluminum channel stock) and the chassis details are given in Figure 5. I prefer BNC connectors for the RF connections as they mount with a single hole and perform better than UHF connectors at the frequencies of interest. The LEDs, switches, and reverse polarity protection diode are wired from the case-mounted components to the circuit board. Don't forget to install the

fuse in series with the DC power plug.

Attention should be paid to standard VHF construction practices. Some pitfalls to be aware of when constructing the amplifier are:

- Components should be mounted flush to the board; i.e., the fixed capacitors should be mounted as close to the foil as possible. Bend the leads perpendicular to the body after removing any enamel from the leads, then solder the components to the board with the minimum lead length possible.

- The wires through the board should be bent into a "Z" shape after insertion through the board prior to soldering.

- Periodically, the flux should be removed from the board during the construction process. Pay particular attention to the striplines

Continued on page 18

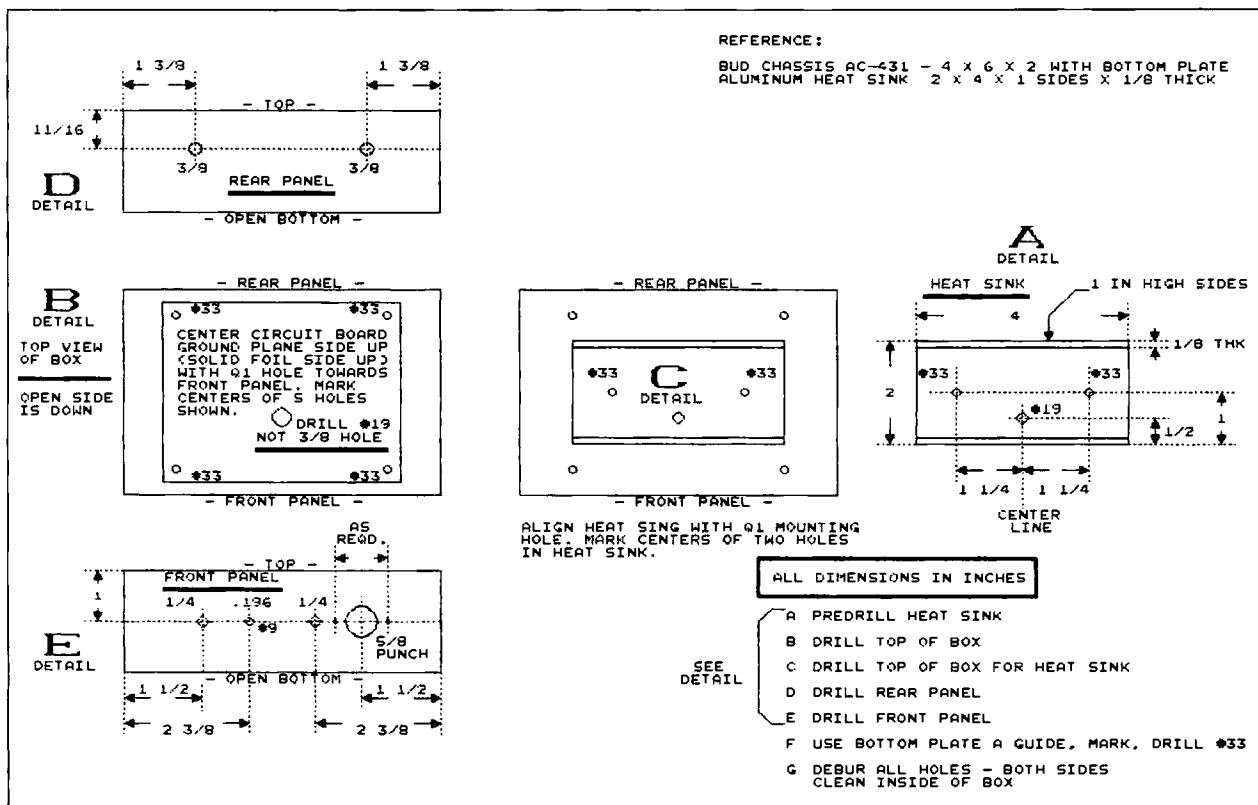


Figure 5. Chassis details.

The FARA Project

Continued from page 16

and the transistor mounting tabs. These areas must be *clean*. If not, you may have some difficulties when tuning the amplifier.

•With the large ground plane of the circuit board you must be careful that there are no cold solder joints. The joints should be shiny and should puddle well after soldering; they should not look crystalline or like a blob. Good soldering techniques are crucial to the performance of the amplifier.

Parts List

Component	Type	No. Required	Source
C1,C2,C4	0.001 μ F	3	
C5,C17	0.1 μ F	2	
C8,C9	120 pF	2	
C10	68 pF	1	
C13,C14	22 pF	2	
C16	3 pF	1	
C3	2.2 μ F	1	
C6,C7,C11,C12	ARCO 423	4	CS/RF
C15	ARCO 424	1	CS/RF
R1,R7	3.3k, 1/4W	2	
R2,R3	10 ohm, 1W	2	
R4,R5,R8	330 ohm, 1W	3	
R6	2.2k, 1/4W	1	
Q1	MRF 1946 A	1	RF
Q2	2N2222	1	
D1	LED—red	1	
D6	LED—green	1	
D2,D5	1N4006	2	
D3,D4	1N914	2	
L1	7T, #18 wound over R8		
L2	4T, #18 3/8" i.d.		
L3	2T, #18 1/8" i.d.		
L5	4T, #18 1/4" i.d.		
L4	0.22 μ H w/ferrite bead		CS
K1	Relay, P/N ME431-ORV-SH-212L		M
J1	2-pin, Jones/TRW/Cinch		
J2,J3	BNC chassis receptacle, UG1094/U		
CH1	Bud chassis AC-431, 4" x 6" x 2"		
BP1	Bud bottom plate, 4" x 6" inches		
HS1	Heat sink, 2 x 1 x 4 channel stock		

Misc. #4 hardware

M: Mouser Electronics, Tel. 1-800-346-6873

CS: Circuit Specialists, Inc., Tel. 1-800-528-1417

Tune Up

The amplifier is quite easy to tune: Only a DC ammeter (5A full-scale), a 12-14 volt 5A power supply, a suitable RF power meter (50 watts full-scale), and dummy load are required. Initially the amplifier should be tuned at 12 volts with an input power of no more than 1 watt. Until the amplifier is completely tuned, RF should be applied to the input for no more than three to five seconds at any one time. Prior to mounting the amplifier in the enclosure you should rough-tune the amplifier. Be sure the transistor is mounted to the heat sink when tuning.

Tune the amplifier as follows:

1. Apply 12 volts, with the ammeter in series with the positive lead. There should be no current indicated on the meter. Set the power switch to OFF, then peak the relay compensating capacitor (C15), if installed, for maximum output in the bypass mode.

2. Turn the power switch ON and apply 1 watt (as noted). The relay should pull in. Tune all capacitors (C6,C7,C11,C12) for maximum output. Do not tune the relay compensating capacitor (C15) at this time.

3. Set the power supply voltage to 14 volts and increase the drive to the maximum 2 to 3 watts input at the transistor. 4 to 7 watts *maximum* at the input of the amplifier, provided the attenuator is in place.

4. Again, tune the capacitors for maximum output.

Pay attention to the current being drawn. You will notice a substantial increase in current when the series output capacitor (C12) is off resonance. Tune the amplifier for the best efficiency; that is, tune for the highest power output consistent with the minimum current being drawn. Nominal values are about 3.5 amperes at 28 watts output.

Results

To date, the 30 amplifiers we have built have been a great success! The primary goal of the Hackers Group—that of introducing new hams to the construction side of the hobby—was met. They were able to construct a useful piece of equipment at a nominal cost and they enjoyed doing it.

This was a group project and everyone who participated contributed to its success. I would personally like to acknowledge the support of four individuals: Don NIJCT, who helped coordinate the project and who prodded me into designing the unit; Bob WIHWU, whose expertise in circuit board fabrication was crucial to the success of the project; Harry W2RKB, who helped with the circuit boards and tune-up; and, last but not least, John NILO, who provided the CAD drawings.

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Improved VOX Mobile Extender

Give your handheld the power of a mobile.

by John Neeley K6YDW

This article improves upon my original "Mobile Extender Using VOX Control" project, which first appeared in the December 1987 issue of 73 (pages 44-45). While the original project worked OK—it had a few drawbacks. For one thing, it utilized parts which are difficult to impossible to find today. This new and improved version solves that problem and goes a step further. It uses commonly available parts but also works quite a bit better. This version also eliminates the intermittent reception problem which cropped up in the original, thereby improving communications.

Why Build the Extender?

This project can be invaluable at parades, public events, and especially in search and rescue work. When the extender is operating, you can leave your vehicle and still be in contact with others on the repeater channel via the extender. This is important if you can't access the local repeater via your hand-

ie-talkie in your portable location. Using the extender allows you to use the higher power mobile radio in your vehicle to access the repeater. You will also have the advantage of a gain mobile antenna over a rubber duckie.

Circuit Description

In the original circuit, the speaker output of the receiver went to an audio transformer, with a diode in series on the secondary, which produced a DC voltage to drive the input of an LM3900 Norton op amp IC. This arrangement was satisfactory, but at times would become intermittent due to voltage changes on the input to the LM3900. The improved version, shown in Figure 1, is not as dependent on varying input voltages, thereby making the circuit more reliable. Voice modulation is no longer required to activate the circuit. Instead, it will activate upon hearing the receiver noise, when the squelch is opened.

Two identical circuits, using a single

LM386 400 mW audio amplifier IC in each channel, instead of a single LM-3900 IC, are built to make the extender. The 1RF511 power MOSFET is available from Radio Shack and other suppliers. If a relay output is desired, the 1RF511 can be replaced by an NPN transistor. The 1RF511 has very low on-state resistance, combined with high transconductance, and the capability of sinking 3 amperes.

When the gate of the MOSFET is driven high, the drain goes low, which will key the T/R relay in the transceiver. The only voltage on the drain is supplied by the relay of the radio. Parallel to the drain output of the MOSFET is an over-voltage protection circuit consisting of a zener diode (Z1, Z2), and a 0.01 μ F disc capacitor (C7, C16) to prevent voltage spikes from destroying the MOSFET.

Diodes (D1, D2) rectify the output voltage of the LM386 IC from AC to DC, to operate the MOSFET keying transistor (or NPN/re-

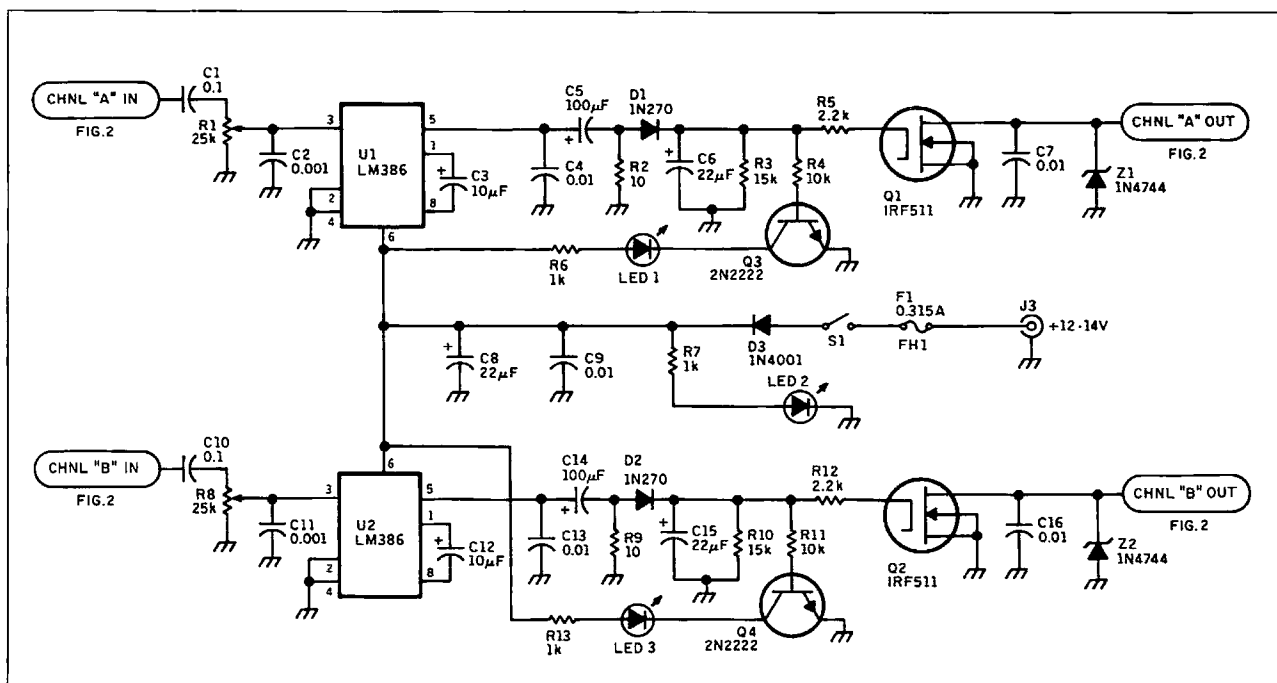


Figure 1. Schematic for the improved VOX Mobile Extender.

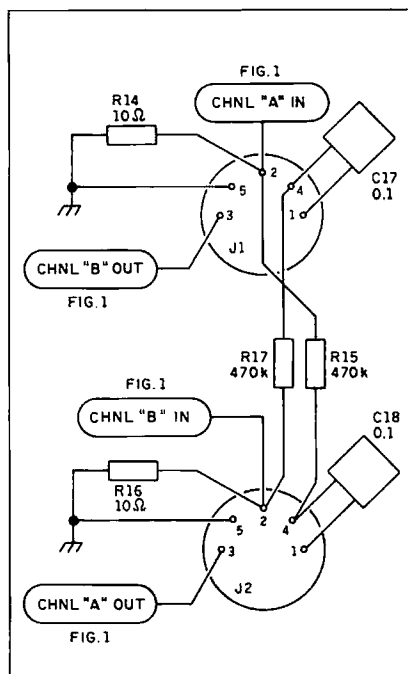


Figure 2. The 5-pin DIN jack wiring.

lay configuration). The LED indicators are optional, but they do give a visual indication as to which channel is active. I use a red LED for "CHNL A," green for "CHNL B," and yellow for POWER ON.

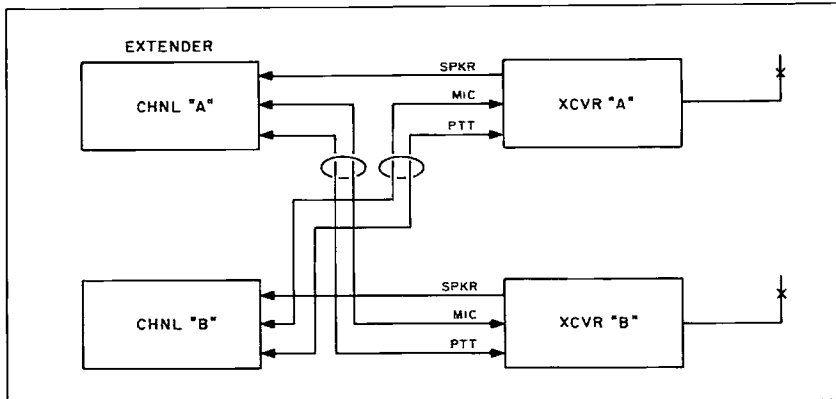


Figure 3. It's easy to hook up the Extender to your radios.

Transmit Audio Circuit

The transmit audio section is identical to the original article. The speaker output of one receiver goes through a 470k ohm resistor (R15, R17), to a 0.1 μF capacitor (C17, C18), then terminates at the microphone input of the other transmitter. The values of the resistor/capacitor network may vary, depending on your radio, but the device has been found to work with several different types. It is suggested that the network be placed directly at the I/O jacks (J1, J2), instead of on the PC board. See Figure 2.

Wiring It Up

Figure 3, the wiring diagram, shows how simple it is to hook it up to your radios.

XCVR "A" speaker output goes to CHNL "A" input; CHNL "A" output (MIC/PTT) goes to XCVR "B" microphone/PTT jack (reverse for the other channel). XCVR "A" should be on your 2 meter repeater channel, or can be on simplex. XCVR "B" can be on your 2 meter repeater channel, or can be on simplex. XCVR "B" can be on any simplex channel, preferably on either 220 or 440 MHz, to prevent desense.

Operation

To use the unit, plug in the appropriate cables to the transceivers. The input/output jacks (J1, J2) of the extender are wired the same, so all you need to make up are the cable connectors going to your transceivers. Refer to your radio's manual for correct wiring and types of connectors required.

Select XCVR "A" to an active repeater channel; set the volume control on the receiver to about halfway on each radio for initial tests. Monitor on another receiver: set to XCVR "B" transmit frequency, and adjust the 25k pot (R1) to where the circuit keys XCVR "B."

Now adjust the receiver volume to where the audio has good quality. Again, these values may need to be changed to fit your radio, but they should be correct for most units. Now you can do XCVR "B," which is the same procedure. The 5-pin DIN jack wiring is shown in Figure 2.

Construction

The circuit can be constructed on a printed circuit board from FAR Circuits (see note at the end of the Parts List). Place the board, along with the associated switches, LEDs and jacks, in a metal box of your choice and mount it in a suitable location near

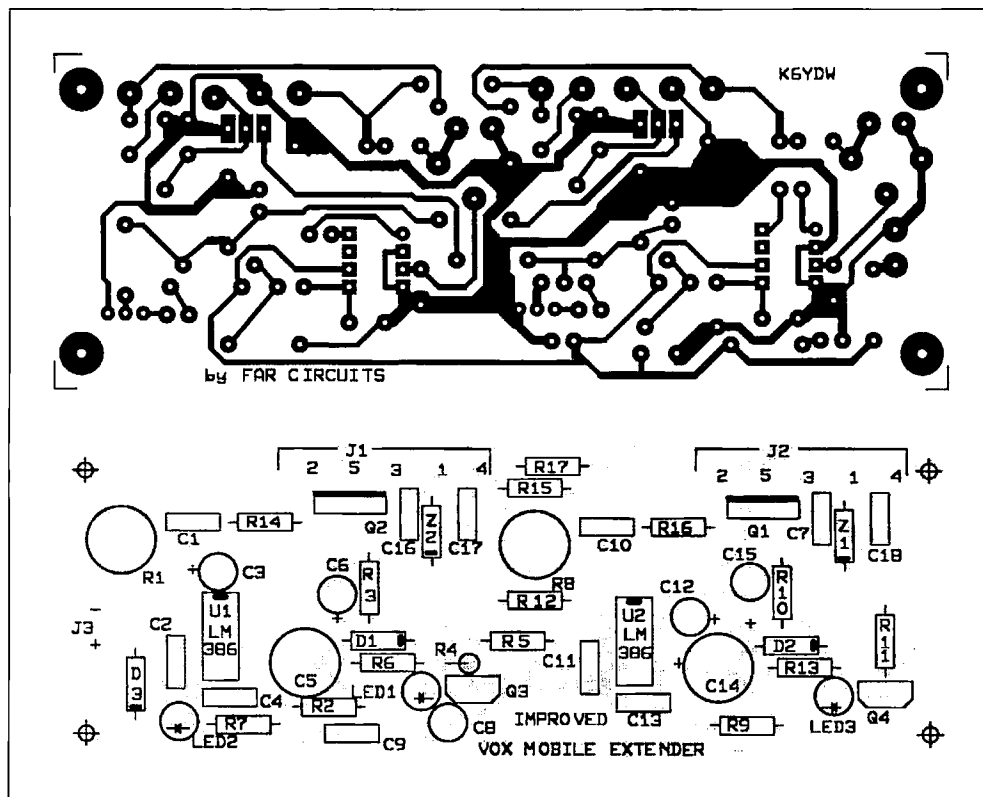


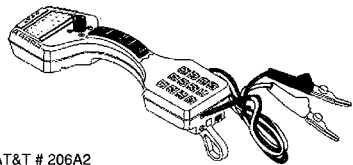
Figure 4. PC board pattern and parts placement.

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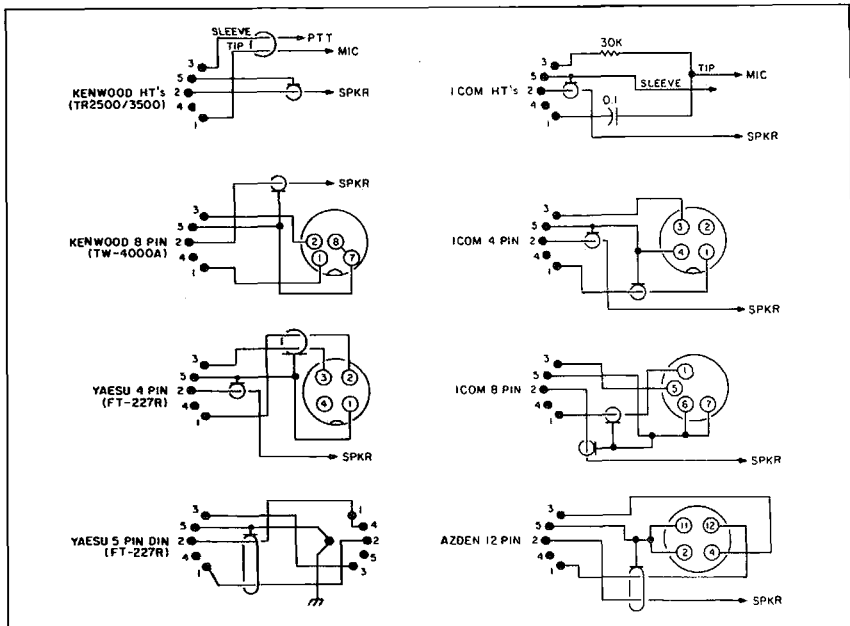


Figure 5. 5-pin DIN plug output to various radios.

the transceivers. The fuse F1 and the switch S1 are mounted off the PC board on the enclosure box. The cost of this project is less than \$50 if all the parts are purchased new; less, of course, if you have a good junk box. Pinouts for various radios can be found in Figure 5 in this article.

Reminders

Remember to wait for the repeater squelch-tail to drop before transmitting through the extender. *Be advised: You have just created a remote base, which you must ID as such, per FCC rules.*

73

Parts List

Integrated Circuit

U1,2

LM386 audio amp

RS 276-1731

Transistor

Q1,2

1RF511 Power MOSFET

RS 276-2072

Q3,4

2N2222 NPN

RS 276-2009

Diodes

D1,2

1N270 (or 1N914/1N4148)

RS 276-1122

D3

1N4001 50V/1A

RS 276-1101

Z1,2

1N4744 Zener, 15V/1W

LED1

Red T-1 3/4

RS 276-041

LED2

Yellow T-1 3/4

RS 276-021

LED3

Green T-1 3/4

RS 276-022

Resistors

R1,8

25k ohm PC mount pot

RS 271-001

R2,9,14,16

10 ohm, 1/2W

RS 271-1337

R3,10

15k ohm, 1/4W

RS 271-1335

R4,11

10k ohm, 1/4W

RS 271-1325

R5,12

2.2k ohm, 1/4W

RS 271-1321

R6,7,13

1k ohm, 1/4W

RS 271-053

R15,17

470k ohm, 1/2W

Capacitors

C1,10,17,18

0.1 µF/50V Mylar

RS 272-1069

C2,11

0.001 µF/50V disc

RS 272-126

C3,12

10 µF/16V tantalum

RS 272-1436

C4,7,9,13,16

0.01 µF/50V disc

RS 272-131

C5,14

100 µF/35V electrolytic

RS 272-1028

C6,8,15

22 µF/16V tantalum

RS 272-1437

Jacks

J1,2

5-pin DIN

RS 274-005

J3

5mm/2.1mm power

RS 274-1565

Plugs

P1,2

5-pin DIN

RS 274-003

P3

5mm/2.1mm power

RS 274-1567

Switch

S1

SPST sub-mini

RS 275-612

Fuse

F1

.315A/5x20mm

RS 270-1249

Other

FH1

Fuseholder, 5x20mm

RS 270-362

Cabinet

PC Board

Metal

RS 270-253

Universal Board

RS 276-168

A drilled and etched PC board for this project is available for \$7.50 plus \$1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

The Solar Control-ar

A solar panel charge controller for all seasons.

by Joel R. Donaldson WB5PPV

My home is on wheels. My ham shack is on wheels. I live in an old motor home, often staying for months in remote areas that lack any AC power. I'm no rugged old geezer when it comes to creature comforts, however. My idea of roughing it is having to warm something up on the gas stove, instead of cauterizing it in the microwave. Given this affinity for modern gadgets (and my inability to convert my Yaesu to operate on propane gas), I've been forced to come up with alternate ways of obtaining electricity for my comfort and pleasure. My RV came equipped with a big, stupid Onan generator. It uses a little less than a gallon of fuel for every hour of operation, regardless of whether or not it's powering anything. It's cranky to start on cold mornings. It interferes with my TV and HF reception. During weekly skeds on 20 meters, I find myself shouting into the microphone to make myself heard over it. It hunts, surges, and revs for no apparent reason. It sets off my smoke alarms, even when it isn't actually on fire. In short, it stinks. Literally.

After several months of power generation aggravation, I bought a combination inverter/battery charger so I wouldn't have to run the generator all the time. It's coolness incar-

nate! It's 85 to 90 percent efficient, and completely silent. You have 120 volts AC whenever you want, with the flick of a switch. Yep, I'll only have to run the generator for several hours a day now, just long enough to recharge the RV batteries, right? Well, not exactly. As it turns out, you can only rapid-charge a lead-acid battery up to about 75 percent of its total capacity. After that, the last 25 percent takes a long time, regardless of how big your battery charger is. Try to save some time by really cranking up the charge current and all you get is a boiling battery with melted plates. Great. Now I can run the generator for two hours to build up the bulk of the battery charge, and then run it for another four or five hours just to top it off. Or I can shut it down after several hours and live with undercharged batteries, right?

Well, not exactly. As it turns out, an excellent method for prematurely ruining a lead-acid battery is to consistently undercharge it. In the process of discharging, the lead plates in a battery are converted to lead sulfate. If the battery is promptly and fully recharged, this sulphation is almost completely driven back into solution, leaving the plates essentially unchanged. However, if the battery is

not completely recharged, the sulphation hardens into a form that is eventually not removable with any amount of recharge. When this happens, there is less plate area available in which chemical reactions can occur, and the battery permanently loses capacity. The process continues until the battery can't hold any charge at all, and . . . it's toss time!

So much for quick charges with the generator. I really need a scheme that provides a gentle, continuous low-current battery charge over long periods of time, say maybe five to eight hours, something that is quiet, doesn't stink or guzzle gasoline, is easy to maintain, and doesn't need to be attended while it's doing its thing.

Well, you know what the answer had to be.

Shortly after I mounted four 53 watt Siemens solar panels on the roof of the RV, I began to search for a good charge controller. I looked at both the store-bought and the roll-your-own types. Most charge controllers don't exactly teeter on the leading edge of technology, but the way some of them work is still kind of neat. Unfortunately, all of them I looked at suffered from at least one of the following maladies:

- 1. They were expensive.
- 2. They were either incapable of controlling a large number of solar panels (typically being limited to a maximum of 8 to 15 amps), or they wouldn't work with anything less than a large number of panels.
- 3. They were inefficient, with a significant percentage of the panel array's total power output being wasted as heat within the charge controller.
- 4. They lacked truly useful metering capabilities.
- 5. They lacked sufficient adjustability, or the adjustments wouldn't stay put.
- 6. They couldn't be manually bypassed in case of failure or for routine battery equalization.
- 7. They had little (if any) immunity to strong RF fields.

With these problems in mind, I set out to design my own controller. In addition to avoiding everyone else's pitfalls, I had to make the final design simple and use readily-available parts. Because several hundred to several thousand amp-hours of storage batteries represent a considerable investment, the design also had to be reliable. No one wants to leave their house, RV or repeater site unattended for an extended period, only to later discover that the controller has failed in the "on" position, indefinitely subjecting their batteries, inverter, radios and other appliances to the full 18 to 20 volts produced by their solar panels. Or, just as bad, failed in the "off" position, with the batteries totally Tango Uniform.

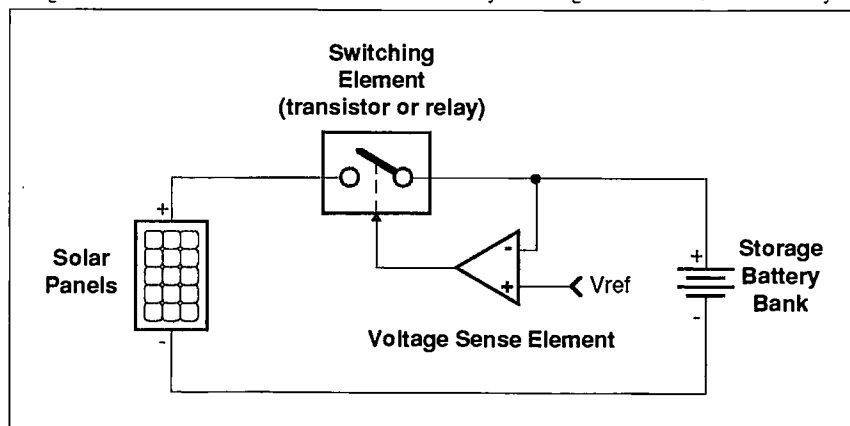


Figure 1. Series control scheme.

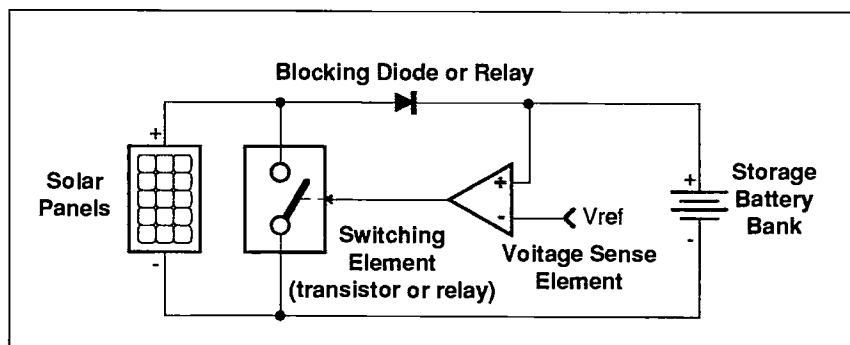


Figure 2. Shunt control scheme.

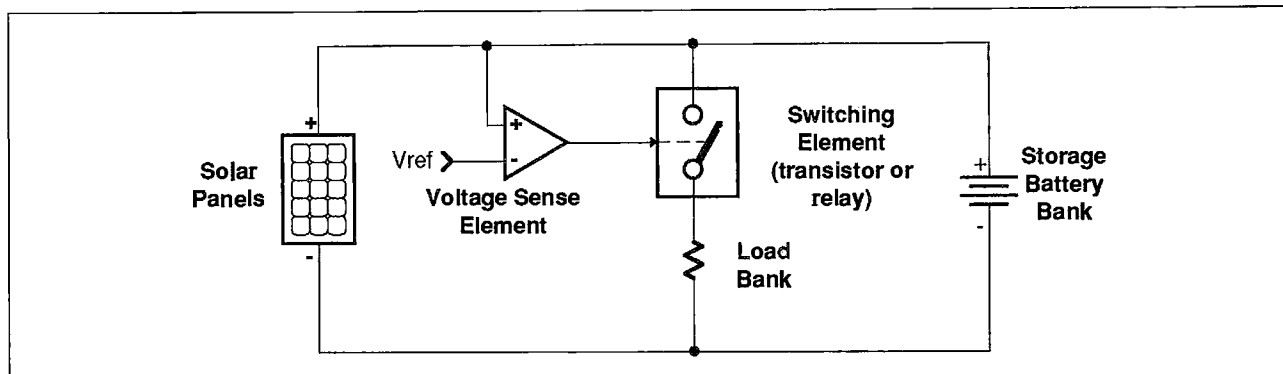


Figure 3. Diversion control scheme.

Series Control Scheme

In my survey of what's already out there, I found that one of three different techniques may be used in the typical charge controller to limit the solar panel's output upon completion of battery charge. Each technique has its own advantages and disadvantages.

See Figure 1. *The series-regulated* approach uses a switch in series (surprise!) with the solar panel output to disconnect the solar panels from the batteries as soon as the desired level of charge is reached. The biggest advantage of this scheme is probably its simplicity. As with the other approaches, the actual switch may be a relay contact, or one or more power transistors. The relay-types cycle on and off at long intervals (from several min-

utes to several hours, typically), while designs that use power transistors may cycle at rates up to several tens of kHz, à la Pulse Width Modulation.

Shunt Control Scheme

The *shunt-regulated* approach shorts out the solar panels as soon as the batteries are charged. Solar panels, being essentially constant-current sources, are in no manner harmed by being shorted indefinitely. The output voltage just drops to almost nothing as the current increases only very slightly above its normal value. With a really low-impedance shunt switch, the shorted-out power dissipation can be held to very low levels. Note that a blocking diode or secondary switch is used

in conjunction with the shunt switch in order to avoid also shorting out the connected batteries (definitely something to avoid!). Although the additional diode or switch complicates this approach somewhat, it still has the advantage of being a relatively simple scheme to implement.

Diversion Control Scheme

Unlike the previous techniques, the diversion-regulated approach doesn't attempt to prevent energy from reaching the battery as it reaches full charge, but instead siphons off excess energy so as to maintain the desired battery voltage. As the batteries top off, the controller automatically switches a load bank across them, so as to keep the voltage from

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Table 1. Meter shunt details (see text).

climbing any higher. As the load bank starts to overwhelm the output from the solar panels, the battery voltage begins to drop, eventually reaching a point at which the load bank is automatically disconnected. This connection-disconnection process continues as long as the solar panels are producing a surplus of power, thereby preventing overcharge. A big advantage of these controllers is that they don't care what sort of power source is actually doing the battery charging; all they are concerned with is keeping the battery voltage from exceeding a set value. This makes them useful in situations where solar battery charging is supplemented by other charging sources (like wind chargers or water turbines). No matter how many different charging sources you add to a battery bank, just one diversion regulator

will control them all, as long as the combined current output from all sources does not exceed that of the regulator or the load bank attached to it. The biggest disadvantage of this scheme is probably the load bank requirement, which forces you to figure out what you are going to do with any surplus power produced by the system.

One nice thing about all three of these techniques is that once the batteries have reached a state of complete charge, the excess solar energy does not necessarily have to be discarded but can be instead used to power other lower-priority loads. In the case of the series and shunt regulation schemes, all you have to do is substitute a power diversion switch for the existing disconnecting or shorting switch. For diversion regulation systems you just con-

nect your alternate load in place of the controller's load bank. Any electrical load will suffice, so long as it is tolerant of frequent disconnects from power. In the case of diversion regulation, the load must also be ever-present, and must be large enough to be capable of swamping the output of the solar panels on even the sunniest of days. Good potential candidates for load banks would include water pumps (you can always stand a little more water in the stock tank as soon as the batteries finish charging), cooling fans (keep the wife and the chicken coop cool) and, in larger solar installations, hot water pre-heating or electrical generation of hydrogen gas (for later use as a fuel).

Note that all three of these regulation techniques are typically implemented with saturated on-off switching. Theoretically, you could incrementally adjust the amount of voltage or current being produced by your panels as the battery charge increased, using pass transistors biased in a linear mode. The biggest practical disadvantage to this technique probably lies in the tremendous amount of heat that would be generated by the pass transistors at any point between saturation and full cut-off. All that heat would have to be dissipated somewhere, and at the very least would result in increased size and cost, due to a rather herky heat sink! So, linear regulation is probably not as well suited to the constant-current nature of solar cells as it is to power sources with essentially unlimited supply currents (like batteries and AC mains). The sole

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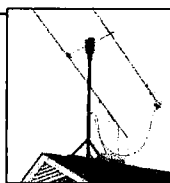
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exception might be in controllers for very small solar arrays, where heat dissipation could be more easily managed.

Anyway, this survey provided a good starting point for my own design. For the switching element, I considered using relays, power BJTs, and power FETs. A power relay looked good from a cost standpoint (you can buy a fog lamp relay at Wal-Mart for less than \$4, and you don't need a heat sink), but the reliability of the contacts would always be suspect. High power FETs are easier to use than BJTs, and are very reasonably priced, so they looked like the best choice. As for the actual circuit configuration, I considered several factors important.

First, the use of a transistor in a series switch arrangement would mean that some power would be wasted in the voltage drop across the transistor when the battery was being charged. This would reduce the efficiency of the charge controller somewhat. Likewise, the use of a shunt switch arrangement would mean that some power would be wasted in the voltage drop across the blocking diode.

Second, the power being dissipated across these components (in either configuration) is significant for rather long periods of time (whenever the sun is shining and the batteries are not fully charged), which could shorten their life expectancy. A diversion regulation scheme avoids these two problems because no switching or blocking device is employed between the solar panels and the batteries, and the diversion load switching device is only operated for brief periods *after* the battery has reached full charge. This implies good efficiency and reliability. Since no blocking diode or series switch is used, there will be some loss of efficiency with this arrangement, due to nighttime solar panel reverse leakage current (typically 15 mA per 50 watt panel), but this is more than offset by the higher daytime efficiency. So there you have it—an FET-switched diversion regulator it is!

From that point on, the design was pretty straightforward. In referring to the schematic, you'll see that U2 compares the battery voltage with a reference developed by U1, and turns on Q1 as soon as the battery voltage exceeds the level set with R12. Q1 in turn grounds the alternate load (R2), which swamps the output current being produced by the solar panels. Note that since the

LM317LZ can't regulate a voltage that approaches its input value (e.g., the battery voltage), it is instead set to a lower reference voltage (approximately 6.5 volts). The R9/R11/R12 pair scale the battery voltage down to a value roughly comparable to this reference. Since the 741 is incapable of output voltage swings completely to ground, U2 compares the battery voltage with a reference developed by U1, and turns on Q1 as soon as the battery voltage exceeds the level set with R12. Q1 in turn grounds the alternate load (R2), which swamps the output current being produced by the solar panels. Note that since the

the controller's resistance to mechanical vibration, a multi-turn trimmer is used for R12 (10 to 15 turns works nicely). The voltage difference between termination and resumption of battery charging (e.g., the charger's hysteresis) is adjustable via pot R13.

In addition to driving Q1, U1 also directly drives the "BATTERY CHARGED" indicator LED. Note that unlike some other charge controller designs, this LED is not lit until *after* the battery reaches full charge.

A single International Rectifier 50 amp

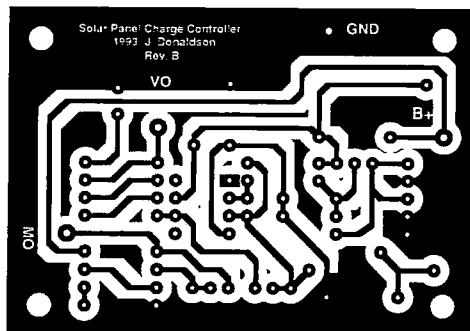


Figure 5. PC board foil pattern (100%) and parts placement diagram (200%).

power FET is specified in the Parts List; it is available from Digi-Key (701 Brooks Ave. South, P.O. Box 677, Thief River Falls MN 56701-0677; telephone 1-800-DIGI-KEY for a free catalog) for around four dollars. Other smaller FETs can be substituted for lower power handling requirements, or several FETs can be paralleled in extremely large installations. I like using a well-oversized FET, for reliability reasons.

The metering circuit I chose measures the amount of current produced by the solar panels, and also determines battery voltage. The vast majority of the charging current is borne by R1, while a small portion of it is diverted through the meter. Since the meter uses a 1 mA movement, the voltage drop across R1 never exceeds 50 mV, thereby minimizing power losses and heat dissipation. Physically, R2 consists of a small coil of 14-gauge household wire, the exact length of which is determined by the desired full-scale reading of the meter. I set mine up for a full-scale current of 14 amps, but Table 1 lists the appropriate lengths for some other full-scale values. I chose 14-gauge because it is readily available in most hardware stores. Solid is preferred over stranded.

To read battery voltage, R4, R5, R6, CR5 and CR6 are used in a voltage-scaling circuit that allows the meter to read from approximately 10 volts no-scale to 16.5 volts full-scale. The expanded voltage scale is important because there is typically less than 1 volt

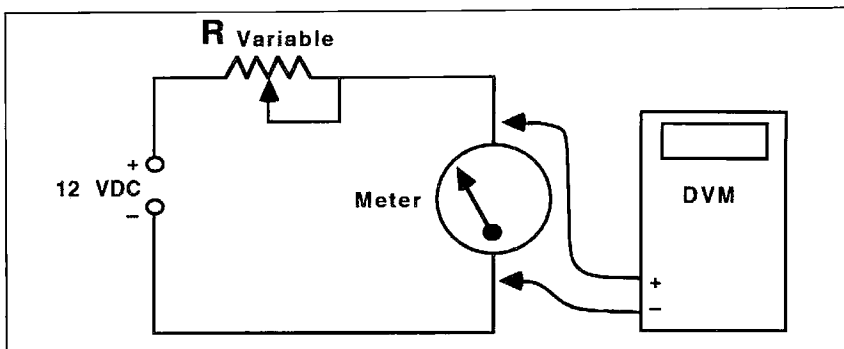


Figure 6. The precise value for R1 can be calculated after finding the meter's resistance value.

of difference between the output of a fully-charged and a fully-discharged lead-acid battery. Any small variations within that 1 volt range would be difficult to read on an analog meter, unless the meter scale was expanded to remove the useless 0 to 10 volt range of readings. (Whether your battery reads 10 volts or something less than 10 volts is immaterial; in either case you have a damn dead battery on your hands!) On the top end of the scale, the normal charge-cutoff voltage for a lead-acid battery can range as high as 14.8 volts, with equalization being safely performed at up to 16.5 volts (see the sidebar on battery charging). This value sets the desired upper range of measurement. For temperature stability, current is always applied to CR6. This repre-

sents a small continuous battery load (less than 20 mA under most conditions), but buys some improvement in meter accuracy.

For ease of construction, a printed circuit board layout has been provided. Almost all of the components carrying low currents mount on it, while the components requiring heavy-gauge wire mount in what ever type of enclosure you desire. I mounted mine in a wall paneling cutout, using the aluminum cover from a bakelite experimenter's box as the front panel. These covers are available without the rest of the box from Digi-Key for under \$2. Make sure that the PC board is mounted so that R12 and R13 can be easily adjusted with everything buttoned together.

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in your installation, R2 can consist of 12 volt light bulbs (headlamps for high current applications; #1141 bulbs for smaller installations), or power resistors. I recommend that the load be spread among several individual resistors or bulbs so that if one burns out, the controller will still function (although at some reduction in overcharge protection). Also, if bulbs are used, be sure to pick a bulb with long life (e.g., 1,000 hours for the #1141, versus only 200 hours for the similar-appearing #1156 bulb). Using 24 volt bulbs in a 12 volt system will also greatly extend reliability, although more bulbs will be required. High-power load resistors can be easily built from scratch with nichrome heating wire (available at most hardware stores), and mounted in ventilated metal boxes, tin cans, etc.

To calibrate the meter for battery voltage, set R5 and R13 at the middle of their ranges, and switch S2 to the voltage scale. Disconnect any alternate load. Apply +10 VDC to the battery terminals and allow CR6 to warm up for a few minutes before proceeding. Adjust R5 to just below the point at which some meter deflection starts to occur. Gradually increase the voltage at the battery terminals, noting and recording the resulting meter readings. (These readings can be used later in relabeling the meter face, if desired). As you increase the voltage, verify that the meter pegs out at a little over 16.5 volts of input. Next, set the input voltage to the desired battery charge cut-off value, and adjust R12 until the

BATTERY CHARGED indicator lights up. There are no adjustments for calibrating the current scale; the current readings can be read off an ammeter connected in series with the positive battery wire, once the controller is installed and hooked up to the panels and batteries. Again, the current readings can be recorded for later use in relabeling the meter face.

During installation, I recommend providing fusing between the charge controller and the batteries, located as close to the batteries as possible. In some larger solar installations, you might want to consider remote-mounting the meter and PC board, if it will save you any appreciable length of heavy-gauge (bulky and expensive!) wire. If going that route, simply mount the PC board, S1, S2, F1, and the meter in a box located for viewing convenience, and mount everything else somewhere directly between the solar panels and the batteries. Small-gauge wiring (e.g., telephone cable) can then be used to connect the two boxes.

After the controller has been installed, readjust R12 for proper charge cut-off voltage. The difference between charge cut-off and turn-on voltage is set with R13, and will vary with battery size and loading. Normally, R13 should be adjusted so that CR4 does not cycle more than several times a second under light battery loads, but should never fail to resume charging when battery voltage drops below approximately 13 volts. There is some in-

teraction between the settings for R12 and R13, so several readjustments may be necessary to get the desired charge cut-off and resumption voltages.

The controller is heavily bypassed for RF interference rejection. For best RF rejection, it is suggested that separate wiring be used to connect the radio(s) to the batteries. A metal enclosure for the controller also helps and, finally, a 100 μ H RF choke can be added in series with the fuseholder in particularly stubborn situations.

If you have access to a computer, laser printer, and drawing or drafting software, you can relabel the meter face in a very professional manner. First, recreate the physical dimensions and markings of the old meter face with your drawing program. Next, substitute your recorded voltage and current readings for those of the existing meter face, in the corresponding positions on the meter scale. Finally, use your laser printer to print the new meter face on large adhesive-backed label paper (Avery 5165 or equivalent), and stick the new face over the old one. Very spiffed!

In conclusion, I think you'll find that this controller is the best battery banger for your buck. It's efficient, reliable, and has all the useful tweaks. Whether you're building a mansion in the middle of nowhere, sticking a TNC on top of the local mole hill, or just need a little something to keep your Argonaut's trolling motor battery from boiling dry, this little baby will do the job.

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Model HF9V-X (shown to the left) for 80/75, 40, 30, 20, 17, 15, 12, 10 and 6 meters.

Model CPX counterpoise kit for Butternut models HF9V-X, HF6V, and HF6V-X; substitutes for ground or elevated radials. Self-supporting tubing bolts onto base of antenna. Mast not provided.

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While most other components in an alternate energy system are virtually indestructible and maintenance-free (with the possible exception of wind chargers and water turbines), the selection and maintenance of electric storage batteries can make or break the entire installation. Make your battery selection carefully and maintain it properly and it will serve you well for years. Make the wrong choice or neglect your investment and you will soon have another opportunity to make a wiser battery purchase!

Storage batteries used in most solar power applications are either lead-acid or NiCd. Lead-acid batteries can be cheaply purchased new almost anywhere, while NiCd cells are generally available only as surplus. The big advantages lead-acid cells have over NiCds are that they are more efficient to recharge (only 15 to 20 percent of the charging energy is lost, as compared to 25 to 35 percent for NiCds), they offer better voltage regulation under load, and they are usually cheaper than surplus NiCds. On the other hand, NiCds are much more tolerant of extreme discharges, and are not as prone to permanent damage due to repeated undercharge or long-term storage in a discharged state. Since the vast majority of solar installations use lead-acid batteries, most the following information will center around them.

Some Battery Basics

The lead-acid battery types that are most common in solar applications are all of deep-cycle design. This is significant, because a deep-cycle design stands up to repeated heavy discharge-recharge usage much better than a battery of ordinary automotive design does. An automotive battery

is designed to deliver very large bursts of current for short periods (when starting a car), and then is immediately recharged (by the car's alternator). Most solar power applications require the battery to provide lesser amounts of current, but provide it for extended lengths of time before receiving any recharge. An automotive battery will lose a significant percentage of its full storage capacity after being heavily discharged just one time. It will typically lose 50 percent of its capacity after 20 such discharge-recharge cycles. (For our purposes, a heavy discharge is one that removes all but 20 percent of the battery's original full charge). By contrast, even the lightest duty deep-cycle battery will typically tolerate 200 to 300 such discharge-recharge cycles before reaching a similar state; some of the heavier deep-cycle designs can exceed 10,000 such cycles. It is a common mistake to purchase the "biggest batteries you can get" for a new solar installation, usually meaning size 4D or 8D truck/tractor batteries (which are conventional automotive designs). Regardless of how "heavy duty" a battery is claimed to be, if it isn't a deep-cycle design, it won't last very long in most solar applications.

The maximum storage capacity of a deep-cycle lead-acid battery is usually specified either in amp-hours or in minutes of reserve capacity. The amp-hour value refers to the number of amps a battery will deliver over a specified period of time (generally implied to be 20 hours, if not specifically stated), before the battery has discharged to a useless level (around 10.5 volts). The reserve capacity value specifies the number of continuous minutes the battery can last while delivering 25 amps, before dropping

to this same 10.5 volts. As a rule of thumb, for the smaller batteries, you can multiply the number of reserve minutes directly by 0.6 to arrive at an approximate equivalent amp-hour rating for the battery. Therefore, a 50 amp-hour battery (or a battery with approximately 83 minutes of reserve capacity) can be expected to deliver at least 2.5 amps for 20 continuous hours, or at least 1 amp for 50 continuous hours. Note, however, that at current drains much higher than those specified at the 20 hour rate the capacity of the battery starts to decline due to internal losses and chemical inefficiencies at high currents. Consequently, this same battery might only be able to deliver 5 amps for nine hours (45 effective amp-hours), instead of the 10 hours (50 theoretical amp-hours) implied by the battery's amp-hour rating. Bigger batteries can deliver higher currents without incurring this effect.

Like all lead-acid batteries, the life expectancy of a deep-cycle battery is directly dependent upon how heavily the battery is discharged before being recharged. Batteries that are routinely discharged to only 20 percent of their rated capacity have a much shorter life expectancy than identical batteries that are rarely discharged below 50 percent. This same trend applies at the extremes—few batteries that are completely discharged will last for more than a few such cycles, and most batteries that are never discharged below 80 to 90 percent of their capacity will last almost indefinitely (given proper maintenance). The moral: Don't buy a 100 amp-hour battery if you are planning on routinely using all 100 amp-hours between recharges. A good rule of thumb states that a deep-cycle battery should be recharged before 80 percent of the capacity has been drained, with 50 percent being even better. Fifty percent discharge represents a good compromise between battery life expectancy and reasonable battery bank size. Therefore, you would do well to buy at least 200 amp-hours worth of batteries to meet your anticipated 100 amp-hour discharge "budget."

Ambient temperature also has a strong effect on battery performance. Most batteries are rated at around 80 degrees Fahrenheit. At higher temperatures they are capable of greater capacity, but their life span is shortened, due to the acceleration of detrimental chemical reactions. At lower temperatures, they last longer than normal (provided the electrolyte is not allowed to freeze), but their capacity drops. At 32 degrees F, typical capacity is reduced by 35 percent; at 0 degrees F, it is reduced by 60 percent; and at minus 20 degrees F,

	Charge Cutoff Voltage:	Maintenance Voltage:	Equalization Voltage:
Wet-Cell Battery @ 80° F.	14.4	13.5	16.3
Wet-Cell Battery @ 100° F.	13.9	13.3	15.8
Gel-Cell Battery @ 80° F.	14.4	13.8	(na)
Gel-Cell Battery @ 100° F.	14.1	13.8	(na)

Table 2. Non-sealed wet cell battery states.

Approx. State of Charge:	Specific Gravity:	No-Load Voltage:
100%	1.270	12.70
75%	1.250	12.50
50%	1.190	12.30
25%	1.150	12.10
DEAD!	1.120	11.80

Table 3. Suggested charge and equalization voltages for various batteries.

it is reduced by better than 80 percent. Their ability to accept a charge also drops along with the thermometer. In general, the best tradeoff between efficiency and long life occurs when the battery is maintained at around room temperature.

As a battery is discharged, the sulfuric acid solution inside each cell is gradually converted to ordinary water. Consequently, the specific gravity of this solution also drops as the battery discharges; this change can be easily measured with a hydrometer in order to determine the battery's state of charge. A good battery hydrometer includes a temperature correction scale (specific gravity versus battery charge varies somewhat with temperature), and will often provide readings that are more precise than those obtained with a voltmeter. Specific gravity readings should be taken by inserting the hydrometer suction pipe into the battery cell, squirting the electrolyte into and out of the hydrometer several times (electrolyte agitation improves accuracy), and then reading the hydrometer while the suction tube is still inserted into the cell. Keeping the suction tube in the cell while taking readings minimizes the chance of spilling the electrolyte on feet, kneecaps, or any other exposed appendages. Read the hydrometer scale at the center of the fluid inside the tube, not at the edges. Note that any heavy battery charge or discharge currents drawn just prior to taking specific gravity or voltage measurements will have an adverse effect on the accuracy of the readings. Specific gravity readings are also helpful in determining the overall health of a battery. For example, differences in specific gravity of more than 0.050 between any two individual cells in a battery generally indicate that the battery is headed for problems. By taking specific gravity readings every month or so you can catch battery problems before they cripple the entire system.

Table 2 is helpful in determining the state of charge of a battery, using either a voltmeter or hydrometer. Note that this table is applicable only to the non-sealed wet-electrolyte batteries. For obvious reasons, a hydrometer should never be used on a sealed battery (wet or gell).

What To Buy

Among the deep-cycle variants, the most common type is the RV/Marine, typically sold by hardware and department stores in automotive package (or "group") sizes 24 and 27. Typical ratings for this class of battery are 70 amp-hours (110 minutes) for the size 24, and 105 amp-hours (170 minutes) for the size 27. These batteries represent a reasonable value in smaller solar systems, or in installations where space is at a premium. However, as deep-cycle designs go, they are lightweights, with relatively short

life expectancy in heavy service. This deficiency is primarily due to the use of thin lead plates used in their construction, and the low antimony content of the plates themselves. The next most common deep-cycle version is probably the golf cart/electric vehicle, typically sold through battery supply houses, some wholesale clubs, and an occasional department store (frequently by catalog only). These batteries are all of 6 volt design (you use two in series to get 12 volt banks), and typically cost a tad more per pair than a single size 27 RV/Marine battery. They provide superior service in most solar applications (due to thicker plates and higher antimony content), and probably represent the best value for small to mid-sized installations. Typical ratings are 220 amp-hours, or 400 minutes of reserve capacity.

Industrial (floor scrubber) batteries are probably best described as golf cart batteries on steroids. They are 6 volt, with much taller cases than golf cart batteries. They are typically rated at around 350 amp-hours, and they also make excellent choices for small-to-mid-sized solar applications. They are available from the larger battery supply houses, or may be special-ordered (along with ordinary golf cart batteries) from auto parts stores like NAPA. High-quality deep-cycle batteries for marine applications are manufactured by Surrrette and by Rolls, in a variety of sizes. They are of very heavy construction, with very thick, high antimony content plates. Many marine supply houses stock them, and they work very well in solar applications.

For non-mobile installations, really large deep-cycle batteries are often employed. For example, 12 volt electric fork lift batteries are available with typical ratings of 1,000 amp-hours. Life expectancy is around 10 years, and the cost brand-new is under \$2,000. Surplus telephone cells are also popular, with ratings of 1,200 to 2,500 amp-hours being commonplace. These cells are sold individually (each cell is 2 volts and weighs between 300 and 500 pounds). Life expectancy is greater than 20 years for new ones.

A good used set will have at least 10 years of life left in it, and is available for around \$400 to \$800 per 12 volt group. Gell-electrolyte (gell-cell) batteries are becoming cheaper and more popular for solar applications. Available in group 24, 27, 4D, 8D and 6 volt golf cart sizes, they offer very good performance, with virtually zero maintenance. Where ordinary "wet cell" batteries require monthly checks of electrolyte levels, the gel cells are completely sealed, with nothing to replenish. They also offer higher charging efficiency than ordinary batteries, and provide slightly higher output voltage down to complete discharge. Examples of this class of battery are the

Johnson Dynasty, Exide Nautilus Megacycle, and Dryfit Prevalier/Sonnenschein/Deka brands. Don't confuse these batteries with the "maintenance-free" wet-electrolyte RV/Marine batteries being sold in some department stores under brand names such as Delco Voyager and GNB Stowaway. Unlike the true gel-cells, these batteries offer little improvement in performance over the standard RV/Marine models.

How To Keep Them Happy

Although routinely overlooked in the battery manufacturers' literature and in many references, most deep-cycle batteries (with the exception of the gell cell and other totally-sealed varieties) are benefited by a periodic, controlled overcharge, often referred to as an equalization charge. To equalize a battery, the charging is allowed to continue for some time past the point at which the battery is normally considered to be "full," taking care to avoid excessive battery heating or electrolyte boil-off. In a typical equalization cycle, the battery voltage is allowed to rise to approximately 16 volts, where it is maintained for up to eight hours by adjustment of the charging current. This process helps to mix up the electrolyte, which otherwise tends to "stratify" (e.g., separate into overlapping layers of acid and water). It is also useful in removing some sulfate deposits. When performed properly, equalization doesn't make the battery boil over, but does produce fairly vigorous bubbling. At the termination of this cycle you can expect to add some water. Most battery manufacturers consider one equalization charge a month to be appropriate for batteries that are in a continuous state of charge and discharge; less often is adequate for batteries that see a lot of standby service. Due to the generation of considerable gas that accompanies this process, equalization should *never* be performed on a sealed or gell-electrolyte battery. (Because their electrolyte is gelled, stratification is generally not a problem with gell-cells, anyway). Also, most 12 volt appliances will not tolerate 16-plus volts, so remember to disconnect everything before you equalize. Table 3 summarizes the suggested charge and equalization voltages for various batteries.

Finally, remember that lead-acid batteries generate highly explosive gasses. The larger the battery bank, the more gas produced. Don't mount any battery in an unvented location, and avoid any sparks or open flame around the battery (particularly during and shortly after recharging). Making or breaking electrical connections at the battery terminals is particularly dangerous. Battery explosions often shower large areas with acid. Wear eye, face and skin protection, and give the bank plenty of time to "air out" before attempting any maintenance or inspection.

If you are buying new solar panels, you will probably find that models in the 47 to 65 watt range represent the best value (e.g., most watts per dollar). If that size range will serve your needs without overkill. This range is where the sales volume currently lies for large-scale power production (e.g., for homes and small businesses). Excellent quality is the rule throughout the industry, with limited warranties typically ranging from 10 to 12 years. Actual expected life is anyone's guess, but figures of 20 to 30 years are routinely tossed around. There isn't too much standardization in panel sizes among the offerings from different manufacturers, so pick your brand and mounting hardware carefully. Also, the power density (amount of power produced per square inch of panel area) varies subtly from one model and manufacturer to the next. This means that in some applications where space is very limited, Model X might meet performance objectives where Model Y wouldn't. In picking a panel model, you should consider the anticipated temperature operating range of the panels, the efficiency of your charge controller, and your battery maintenance requirements. As the temperature of a solar panel rises, its output voltage drops. If your panels will be located in a very hot climate and/or are mounted in such a manner as to hinder air circulation around both surfaces, you should limit your panel selection to models that offer the highest charging voltages (typically around 17 volts at rated output current). Some of the lower-voltage "self-regulating" panels are designed to be used without a charge controller in applications where the load attached to the battery is anticipated to be constant enough to avoid boiling dry the electrolyte. Since the output voltage of these panels has been intentionally reduced, the likelihood of battery damage is small. Unfortunately, so is the likelihood of ever fully recharging the battery. High temperature becomes even more important if you will be periodically equalizing your batteries, since this process can require better than 16 volts under full load from the panels.

Finally, if the output voltage of your panels is marginal under hot conditions, a charge controller with excessive internal losses may aggravate the problem. Try to pick a controller that has less than 0.5 volts of drop under your maximum anticipated charge current (the controller described in the accompanying article has virtually no internal losses). If you will be buying your panels surplus, you are pretty much stuck with what's available. If possible, obtain permission to return the panels for a refund if an initial test shows that they are producing considerably less than their new rated current and voltage. Look for water leaks in the seams of the panel glass. If the panel has

Continued on page 38

Parts List

Resistors (1/4 watt 5% unless otherwise stated)

R1=Meter Shunt (see text and note below)
R2=Alternate Load (see text)
R3=5.1 ohms
R4=1 ohm
R5=100 ohm single-turn, linear taper trim pot. Bourns series #3323W or series #3362U. Available through Digi-Key.
R6=100 ohm
R7=1K
R8=240 ohm
R9=10K
R10=10K
R11=4.7K
R12=10K multiple-turn linear taper trim pot. Bourns series #3006P or Spectrol series #43P. Available through Digi-Key.
R13=1M single-turn linear taper trim pot. Bourns series #3323W or series #3362U. Available through Digi-Key.
R14=2.2K
R15=10K
R16=470 ohm

Capacitors

C1=100µF 25V electrolytic
C2=2.2µF 16V electrolytic
C3=0.1µF ceramic disk
C4=0.1µF ceramic disk
C5=0.1µF ceramic disk
C6=0.1µF ceramic disk

Semiconductors

CR1,2,3,5=1N914 small signal Diodes
CR4=LED
CR6=9.1v, 1w Zener diode
Q1=IRF-Z40 50 amp power MOSFET
U1=LM317LZ 3-terminal adjustable regulator
U2=741 single op-amp

Meter

M1=0-1mA

Switches

S1=SPST
S2=SPDT

Fuse

F1=0.5A

Miscellaneous

heat sink
enclosure
fuse holder

Drilled and etched PC boards are available for \$3.50 plus \$1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

Note (Calculating R1): Due to the large amount of current and very low resistance value of R1, this resistor is best built from scratch. R1 is an ammeter current shunt, and physically consists of nothing more than a precise length of 14 gauge household wire. The proper wire length is shown in Table 1. There is nothing unusual about building it—it can be wrapped in a coil, wadded-up, or just left hanging. As shown in the schematic, meter M1 is connected through it with a couple of ordinary hook-up wires. Since the vast majority of current is carried through R1, the wires to the meter can be of most any convenient gauge.

The value for R1 can be determined after the decision is made on maximum current through shunt load R2 and the full scale meter movement current and meter resistance. All current meters have some small value of resistance. If you don't know that value, you can calculate it with a simple experiment:

Let I_M = full scale meter movement current

R_1 = meter shunt resistance

I_L = maximum load current into the shunt R_2

R_M = resistance of the current meter

Take a variable resistor that has a value of $2 \times 12 \text{ volts}/I_M$.

If the I_M current is 1 mA, then the variable resistor should be greater than 12 kΩ or approximately 30 kΩ. Connect the meter and variable resistor (*adjusted to maximum resistance*) as shown in Figure 6. Slowly adjust the resistor until the meter is reading full scale (1 mA in this example). Now measure the very small voltage drop across the meter with a DVM. This voltage drop divided by the full-scale current meter reading will be the meter resistance R_M .

Now the value of R1, the shunt resistor, can be determined for the full scale current meter with the calculated meter resistance of R_M :

$$R1 = \frac{I_M}{I_L} R_M$$

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50 MHz					
0503G	1-5	10-50	6	15/0.6	LPA
0508G	1	170	28	15/0.6	Standard
0508R	1	170	28	—	Repeater
0510G	10	170	25	15/0.6	Standard
0510R	10	170	25	—	Repeater
0550G	5-10	375	60	15/0.6	HPA
0550RH	5-10	375	60	—	Repeater HPA
0552G	25-40	375	55	15/0.6	HPA
0552RH	25-40	375	55	—	Repeater HPA
144 MHz					
1403G	1-5	10-50	6	15/0.6	LPA
1406G	25	100	12	15/0.6	Standard
1409G	2	150	25	15/0.6	Standard
1409R	2	150	24	—	Repeater
1410G	10	160	25	15/0.6	Standard
1410R	10	160	24	—	Repeater
1412G	25-45	160	20	15/0.6	Standard
1412R	25-45	160	19	—	Repeater
1450G	5	350	56	15/0.6	HPA
1450RH	5	350	56	—	Repeater HPA
1452G	25	350	50	15/0.6	HPA
1452RH	25	350	50	—	Repeater HPA
1454G	50-100	350	40	15/0.6	HPA
1454RH	50-100	350	40	—	Repeater HPA
220 MHz					
2203G	1-5	10-40	6	14/0.7	LPA
2210G	10	130	20	14/0.7	Standard
2210R	10	130	19	—	Repeater
2212G	30	130	16	14/0.7	Standard
2212R	30	130	15	—	Repeater
2250G	5	220	40	14/0.7	HPA
2250RH	5	250	40	—	Repeater HPA
2252G	25	220	36	14/0.7	HPA
2252RH	25	250	36	—	Repeater HPA
2254G	75	220	32	14/0.7	HPA
2254RH	75	250	32	—	Repeater HPA
440 MHz					
4403G	1-5	7-25	4	12/1.1	LPA
4410G	10	100	19	12/1.1	Standard
4410R	10	100	18	—	Repeater
4412G	20-30	100	19	12/1.1	Standard
4412R	20-30	100	18	—	Repeater
4448G	5	100	22	12/1.1	HPA
4448R	5	100	22	—	Repeater HPA
4450G	5-10	175	34	12/1.1	HPA
4450RE	5-10	175	34	—	Repeater HPA
4452G	25	175	29	12/1.1	HPA
4452RE	25	175	29	—	Repeater HPA
4454G	75	175	25	12/1.1	HPA
4454RE	75	175	25	—	Repeater HPA



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50 MHz	0520N	.5	25	N
144 MHz	1420B	.5	24	BNC
144 MHz	1420N	.5	24	N
220 MHz	2220B	.5	22	BNC
220 MHz	2220N	.5	22	N
440 MHz	4420B	.5	18	GNC
440 MHz	4420N	.5	18	N
1.2 GHz	1020B	.9	14	BNC
1.2 GHz	1020N	.9	14	N



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The Solar Control-ar

Continued from page 36

bare wires for electrical connections, wiggle the wires while checking the output under load to insure that the panel connections are not intermittent. A panel with faulty connections will often show sufficient output voltage under no load, but will drop to almost no output when any appreciable current is drawn. Beware of stolen panels. Some bargain panels being sold at flea markets were originally "liberated" from mountaintop radio sites or RV'ers in the desert. If the panels are engraved or otherwise marked, make sure that the seller has a believable story as to their ancestry. Take names and addresses.

In most installations, you have a choice between tracking the sun with the panels, or leaving the panels in a fixed position for the day. Auto-tracking panel mounts are commercially available (or can be fun to design

and build yourself), but they do add some expense and maintenance requirements to the system. If the size of your system is marginal, buying additional fixed panels might be just as cost-effective as installing trackers. During the wintertime, much of the advantage in tracking the sun is lost, since it never rises very far above the horizon, and doesn't travel very far horizontally between sunrise and sunset. Also, on overcast days, it makes little difference which direction the panels are facing, but installing additional panels will always provide some additional output. However, if you don't use a tracking system, be sure to include provision for seasonally changing the elevation of the panels. An adjustable bracket costs little more than a fixed mount, and the improvement in power output is almost always significant. **73**

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Kinda picky, aren't you? Good thing that John Ramsey of Ramsey Electronics thinks the same way you do, and makes the FX-146 transceiver kit!

Overview

Yes, the FX146 is a pretty neat piece of work, and a proud successor to the original FTR-146 kit, introduced in 1991. For your money, you get a state-of-the-art radio with a professionally-screened G10 circuit board that's easy to put together, easy to test, and works very well on the air. Bells and whistles have been kept to a minimum, with the emphasis on a well-thought-out design employing the Motorola 145152 phase-lock-loop synthesizer chip and your everyday, garden variety 1N914 diode for frequency selection (see Photo C).

The concept behind this radio is simple, but clever: Build your own 2 meter radio, and while you do you'll learn how all of the parts and circuitry work. Should repairs be required, you won't hesitate to open the cover and "dive in" to fix it. What's more, you'll take more pride in this radio precisely because *you built it your-*

self. (And, of course, let's not forget that you saved a few dollars along the way!)

I bought my FX-146 at Dayton '93 strictly on impulse—it was, after all, a rainy day—so after a brief discussion with Tom Hodge WA2YTM at the Ramsey booth, my wallet was lighter and my carry-all bag somewhat heavier. Tom figured it would take me about three evenings to put the kit together and get it on the air. (Note to novice builders: The term "evening" is a standard measurement among kit builders that has about as much relevance today as "fur-longs per fortnight." A more realistic appraisal of the time required to build this kit might be six to eight hours, depending on how methodically you work.)

When you first open up the kit package, you'll notice all of the parts and the circuit board neatly sorted into clear ziplock bags. All parts are clearly identified, and all ICs are wrapped in foil for static protection.

If you bought the chassis and knob kit, it too is packaged carefully to minimize scratching. But the best part of the kit is the instruction manual, which answers every possible question you could have as you proceed with assembly.

This manual is over 130 pages long and contains detailed parts lists, assembly instructions, schematics, a parts overlay, and a good deal of what I call "pep talk"—additional material not usually found in kit instructions which is designed to motivate you to want to build the kit and have fun while doing so. In some cases this is nothing more than illustrating how simple the step-by-step procedure is.

The manual also provides a good many helpful notes and tables on how synthesizers

work, how to select the right antenna, and how to select and program your desired channels. I've built quite a few kits over the past 25 years, so believe me when I tell you the manual can make or break a kit! The standard for me has always been the Heathkit manuals, and the FX-146 manual compares favorably with any I've seen from Benton Harbor.

Construction

Kit assembly is fairly simple. I suggest locating a number of half-pint plastic deli containers to hold all parts as you proceed. Another useful trick is to double up a piece of masking tape, stick it to your work surface and use it to hold loose components until needed. Many of the parts supplied are already attached to taped rolls, such as the 1N914 diodes and many small capacitors and resistors. A low-wattage iron (say, 40 watts) as well as a pair of diagonal cutters and small pliers will suffice as your tool kit for most of the assembly.

Like the aforementioned Heathkit manuals, Ramsey employs the double-check system during assembly. You locate the part, install it, solder and then "check off" the corresponding box next to that instruction. After you finish a section of the board, you go back, inspect your work and check off again to confirm you did the step correctly. A simple idea, but it really works! Even experienced kit builders such as myself find this system very helpful.

Before you begin each section, there is a thorough description of the circuit and how it works—sort of a mini-tutorial on the fly. After reading these sections, you then proceed to actual assembly. Ramsey's approach is to divide the construction into 11 stages. As you finish each stage, you can perform a short test to make sure everything was done correctly. This will do wonders for your confidence as you proceed to the next section, and should a problem develop it can be isolated and fixed quickly.

Once all of the stages have been tested (with the exception of the RF amplifier), you'll need to load up at least one diode matrix into a channel. I found the easiest way to do this was to raise up the edges of the PC board on two wooden blocks about three inches above my workbench. This allows you to drop all of the diodes through their PC mounting holes and solder the cathode ends to the U-shaped buss bar. Once you've done this, flip the board over and solder the anode ends to the PC board traces.

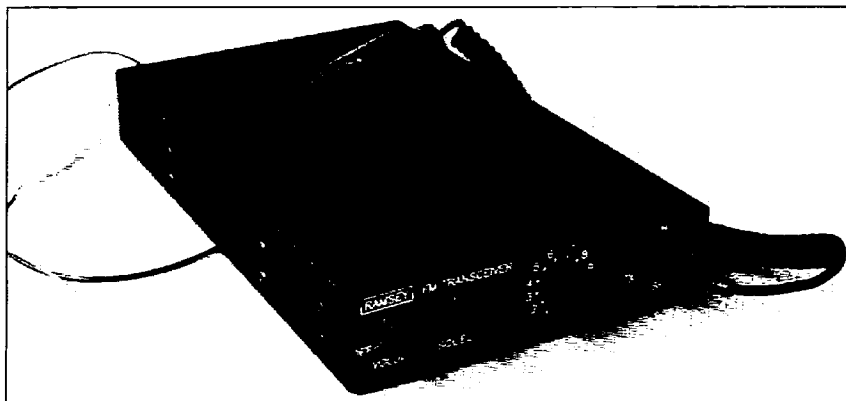


Photo A. The Ramsey FX-146 2m FM transceiver kit.

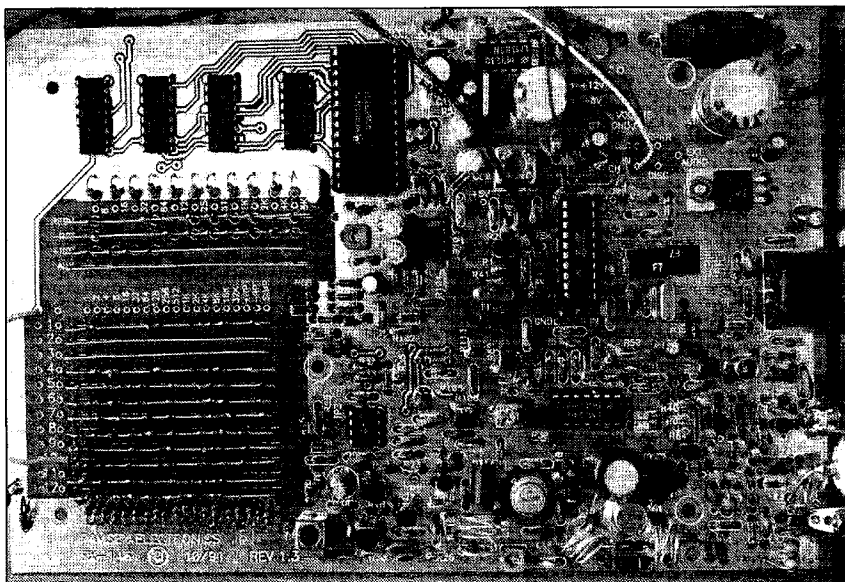


Photo B. Close-up of the FX-146 (top view) showing all components. Note the clean, simple design.

Clip excess leads off carefully.

One word of advice when doing this: Make sure you solder the cathode-to-buss connections carefully. It might even be advisable to bend the diode leads into a hook and hang them over the buss wire before soldering. I had

a few cold connections and certain channels wouldn't work when selected.

Performance

The FX-146 works surprisingly well, given the simple design. Front-end sensitivity is

claimed to be less than $0.35 \mu\text{V}$ for 12 dB SINAD, and my tests showed this figure to be closer to $0.30 \mu\text{V}$. Adjacent channel rejection is specified to be down 6 dB ± 7 kHz, and -60 dB ± 15 kHz, which is pretty tight. An option included with the kit will improve front-end performance even more for those in high-RF-density urban areas, although I haven't found it necessary yet.

The squelch threshold is specified at 0.25 μV , and again I found this to be somewhat lower. Squelch hysteresis performance is good, but I found the loud "pop" objectionable each time the squelch was broken or reset. This is caused by the "gating" of the audio output IC, a LM380 linear device. A call to the factory resulted in a modification to change C48 from a 0.001 disc to a $10 \mu\text{F}$ electrolytic, ostensibly to filter out this pop when the IC turned on. The fix made a slight improvement, but the pop is still somewhat annoying.

The FX-146 is set up to select any of 12 preprogrammed channels, the theory being that most users of synthesized radios rarely use more than 10 to 12 memory channels to begin with. This is certainly true in my case, as I use a Kenwood TM221A with 10 memories for day-to-day 2 meter operation. Actual channel selection uses a conventional 12-position single-pole switch to send 5 volts to the desired channel buss. It's not sexy, but sure is simple and reliable! Synthesizer lock-up

66 The R8 is like a breath of fresh air, with its ground-up engineering and up-to-date digital control from the front panel... a quality HF receiver of American manufacture that should successfully compete on the world market. 99

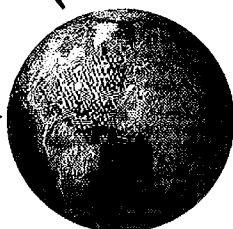
Bill Clarke
73 Amateur Radio Today

66 Overall, the Drake R8 is simply the best radio we have ever tested for quality listening to programs... There's nothing else quite like it. 99

Lawrence Magne
Monitoring Times

66 The best of the best for high-quality listening to news, music and entertainment from afar. Superb for reception of faint, tough signals. 99

Editor's Choice
Passport to World Band Radio
Tabletop Receivers for 1992

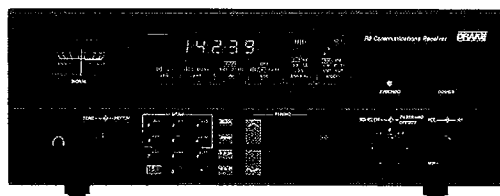


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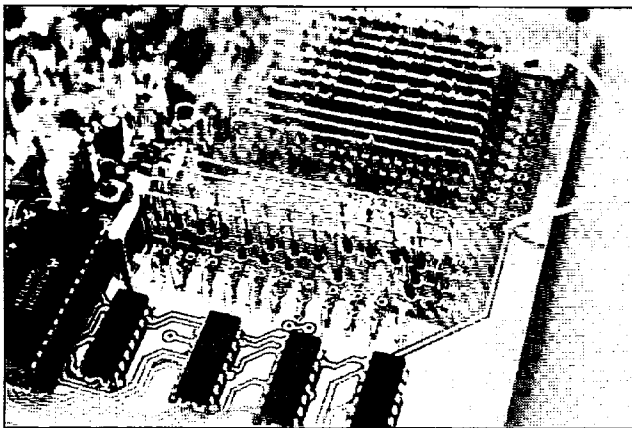


Photo C. Close-up of the diode matrix area, showing the buss connection technique.

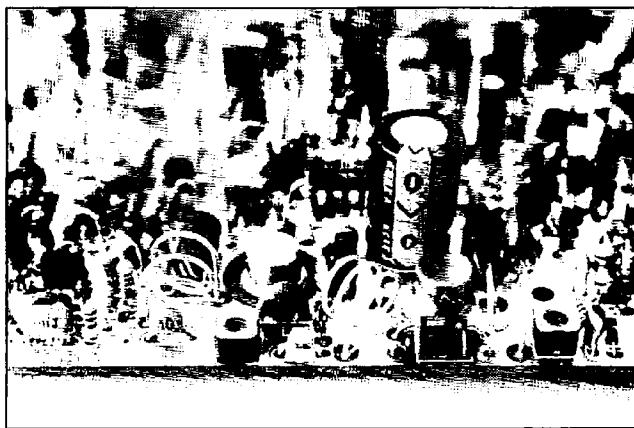


Photo D. Close-up of the final amplifier assembly, showing the trimmers and output coils.

was quick and reliable on every channel (except where I made a couple of cold solder joints).

On-air reports were good. Initially, I was told my audio had a fairly noticeable hum which disappeared when I replaced the ICOM HM-9 speaker/mike with an HM-54. Transmitted audio quality was excellent, and there's plenty of headroom on the microphone gain control although there is no separate deviation control. The FX-146 uses true direct frequency modulation, by the way.

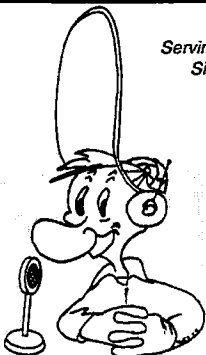
Output power is specified in the 4 to 6 watt range, but try as I might, I couldn't squeeze more than 3.5 watts out of the FX146 anywhere in the band. (I used a Bird 43 with 10C and 5C slugs plus a Bendix 50 ohm termination to make these measurements.) Note that the driver and final RF stages use lumped, Hi-Q tuning coils and trimmers (Photo D), and once you've peaked up the trimmers you'll see a fall-off in power if you move up or down the band more than half a megahertz. Still, this power level is more than adequate for most

contacts through a repeater, and with an omnidirectional antenna or small beam, you'll get out a good distance.

Overall, the FX-146 represents an excellent value for the money. Its performance is on a par with any other 2 meter transceivers on the market today (other than the squelch pop), and it is easy to assemble and test . . . thereby making it easy to troubleshoot later if repairs are needed. If you really want to "build it yourself," you'd be hard pressed to beat this kit for fun and utility.

73

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The POWER STATION provides 12V from a cigarette plug and has two recessed terminals for hardwiring. A mini-phone jack with regulated 3V, 6V, or 9V output can be used separately for CD players, Walkmans, etc. THE POWER STATION can be charged in an automobile in only 3 hours, or in the home in 8 hours. The charger will automatically shut off when the battery is completely charged, so you can charge it even when it has only been slightly discharged, (unlike Ni-Cads that have memory). Our charging circuit uses voltage sensing circuitry, other brands are timed chargers which always charge the battery a full cycle, this damages their battery and shortens its' life if it only needs a partial charge. The POWER STATION has a voltmeter that shows the exact state of charge of the battery, not worthless idiot lights that tell you "YOUR BATTERY IS NOW DEAD." The voltmeter can even be used to measure voltages of other sources.



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73 Review

by Gordon West WB6NOA

Azden AZ-61 6m FM Transceiver

Advanced features in the palm of your hand.

Azden Corporation
147 New Hyde Park Rd.
Franklin Square NY 11010
Telephone: (516) 328-7500
Price Class: \$379 plus \$5 shipping

The 6 meter band is brimful of excitement for every ham, from the new no-code Technician to the seasoned Extra Class. But don't get the wrong idea—even though 6 meters is exciting, there's still plenty of elbow room in the sparsely-occupied spectrum from 50 to 54 MHz.

FM is the predominant mode on 6 meters. There should be no FM operation below 50.30 because this area is reserved for the SSB and CW weak-signal operation found in large multimode mobile and gas station equipment. Remember: *No FM below 50.30 MHz!*

A good way to get started in 6 meter FM communications might be to pick up a good hand-held transceiver. And while you may think that a measly 3 or 4 watts output won't do much on the 6 meter band, keep in mind that this is the same amount of power output found in 2 meter handhelds.

One unique characteristic of the 6 meter band is it allows small hand-held transceivers to work distant repeaters just as far as on 2 meters, and will sometimes give you *real* FM excitement during periods of ionospheric sporadic E band openings. You may find yourself working through a repeater 1,200 miles away, thanks to brief skywave band openings. And keep in mind that sporadic E band openings are not dependent on the 11-year solar cycle. You can count on 6 meter skywave activity during the summer and fall seasons. And while it may only last for a few minutes to a few hours, hand-held operation gets exciting—especially if you are hooked into an outdoor antenna.

The Azden AZ-61 6 meter hand-held transceiver is available direct from the manufacturer: Azden Corporation, 147 New Hyde Park Road, Franklin Square NY 11010

(516/328-7500), Attn: Sid Wolin K2LJH, Manager. The Azden line of amateur radio equipment has been around as long as the synthesized 2 meter transceiver, and is now available direct from New York.

the Azden 2 meter owner's manual. We are told that a 6 meter manual is in the works, but the variations between how a 2 meter Azden works and how the little 6 meter handheld works are minor. Well, almost . . .

"A good way to get started in 6 meter FM communications might be to pick up a good hand-held transceiver."

This Azden looked perfect for the Southern California 6 meter Club. They were searching for a quality hand-held 6 meter transceiver that they could order in quantity. The unit

channels in the VFO and memory mode are slightly different for the 6 meter unit than what is described in the 2 meter owner's manual.

The Azden 6 meter handheld is packed with all the usual accessories, including the 8"-long flexible rubber antenna, sturdy belt clip, and the large 12 volt, 600 milliamp hour, rechargeable battery. The battery is shipped uncharged from the manufacturer, so you will need to drop it in its included pull-out desk charge stand and let it cook for at least six hours before turning on the juice. The charger puts out 300 milliamps, and the transformer is housed in the plug-in assembly, hogging an adjacent 110 VAC receptacle beside it if you plug it into a power strip. And be assured that this charging base setup is unique to Azden's line of handhelds, and there is zero chance that it is interchangeable with any other handheld from any other manufacturer. Why won't manufacturers ever standardize their batteries or chargers?

On the top of the handheld is a 12-volt DC input receptacle, with the center-pin positive. *Watch out—even though you may already have a mobile 12 volt hand-held plug that looks similar to this jack, make absolutely sure that your 12 volt plug has the center hole as positive.* Some other handhelds run positive on the outside of the plug, not the inside hole.



The Azden AZ-61.

sounds fine on the air, and most members are relatively satisfied with their purchase.

Features

The review transceiver was shipped with

Reverse polarity means instant destruction to the 12 volt DC input circuitry to this handheld.

During our testing, we discovered that the 12 volt input circuit does not charge the attached battery. This was not a surprise—some handheld manufacturers provide a 12 volt regulator for mobile charging, but others don't. We *did* find that there is a small "buffer" circuit off the external 12 volt line to help minimize alternator noise that sometimes creeps through on transmit. On this unit, we judged this circuit as average. If you have an aggressive 12 volt alternator, you're going to hear it over-transmit on the Azden—as you would on any inexpensive handheld.

Operating: Read the Book First

The Azden 6 meter handheld is not easily operated without a thorough review of the instruction book. Most seasoned hams can figure out the simple operation and memory channel steps of most handhelds without a book—except for maybe the Kenwood 78—but with this Azden, you must read first.

To enter a frequency like 52.525 MHz, first hit the "VFO" key, then enter "2," "★" (Del), "5," "2," "5," and the unit continues to blink for about a second until it locks on. If you don't hit the "★" (Del) key to set the decimal point, the unit won't take the frequency, and will continue to flash at you for about 10 seconds after your last futile keystroke. After 10 seconds, it figures that you need some help, and goes back to the last valid frequency entered. Remember: *Read the book before operating.*

Once the set accepts the valid frequency entry, it reads out "52.525" and does a nice job of capturing any signal out there on frequency. The receiver was plenty sensitive down to 0.08 μ V, and with dual conversion was tight enough to offer excellent selectivity from other stations slightly higher and slightly lower in frequency. The Azden 6 meter handheld utilizes a hard-squelch circuit, and marginal signals will cause the squelch to clamp with a noticeable "pop" as an internal transistor clamps the audio off. But if you accidentally forget and turn down the volume, this hard squelch "pop" might get your attention in a quiet room—there may be someone on channel trying to get through. Few handhelds offer "soft squelch," and in strong signal areas where most operating is through repeaters, the hard squelch in this unit is perfectly acceptable.

Audio output and fidelity from the internal speaker are excellent. If you plug in the optional external speaker/mike, you'll have more than enough audio to hear any call to you (if the speaker/mike is anywhere near your ear). Good news: Many of the generic speaker/microphones have the same exact plug complement that the Azden accepts. Some of the external crossband speaker/microphones run a little hot on transmit modula-

tion, so double-check your levels after you get your external setup plugged in.

The Azden 6 meter handheld offers 40 channels of memory, 20 in memory bank A and 20 in memory bank B. You select the memory bank channel by pressing "function" A/B, and then pressing the number of the memory channel desired. To enter a frequency into a memory channel, you must first recall the memory channel you want to program. Then press VFO, and set the frequency.

For the offset, you hold the function button on the side of the unit while depressing the

CTCSS decode
CTCSS encode
Frequency step
Scan hold time
A-bank scan skip
B-bank scan skip
Automatic power off time
Battery saving time
DTMF pager/calling

And there are even a few more things that you can do with this handheld, which we would classify as "advanced operating features."

"The set is too darn complicated," comments an active 6 meter enthusiast. I didn't

find this necessarily true—I must admit it's certainly not a handheld that you can take out of the box, and start punching in frequencies, offset, and tone without looking at the instruction manual (like some handhelds I know of). But if

you do read the instruction manual, the operating and programming is easy.

This IS an advanced-feature handheld, so it takes about an hour of programming in order to get the "feel" for how frequencies, offset and tone get memorized.

About the only thing I found a problem with was slow synthesizer lock time which all but eliminates the capability of cycling through frequencies with the up or down arrow looking for activity. As soon as you press the up and down arrow frequency slew button, the receiver blanks out until you release the button. You could electronically scan the 6 meter band for activity, but I like to go into the manual mode, and search down at the cordless telephone frequencies near 46 MHz and 49 MHz and see what all I can pick up. (Cordless is legal.) Lots of excitement here!

So, I like it. I like the Azden AZ-61 6 meter handheld a lot. Just be sure to read the instruction manual first!

73

"Good news: Many of the generic speaker/microphones have the same exact plug complement that the Azden accepts."

number 9 key. This allows you to select no offset simplex, minus 500 kHz offset down, or plus 500 kHz offset up. No oddball offsets are available on this unit.

To encode a subaudible tone, you hold the function button again and push the zero key. This activates the "PROG" program display, and you cycle with the pound key (#) past "T.SQ" tone squelch decode, and TO "Tone" for tone encode. Cycle up to the desired tone by exact tone frequency, and then wait approximately five seconds for the unit to time out of the program mode, and get you back into the VFO display mode. Now depress the function button again and the "3" key, and this brings up the word "Tone," indicating CTCSS encode each time you transmit.

Now, memorize this package into any one of 20 + 20 memory channels by holding the "ENT/MW" pound key until you hear a beep.

There are several other options that you could program on each memory channel, too:

ARRL 6 Meter Wavelength Band Plan, 50.0-54.0 MHz

MHz	Use
50.100-50.300	SSB,CW
50.100-50.125	DX window
50.110	SSB calling frequency
50.300-50.600	Non-voice communications
50.620	Digital/packet calling frequency
50.800-50.980	Radio control, 20 kHz channels
51.000-51.100	Pacific DX window
51.120-51.480	Repeater inputs (19)
51.120-51.180	Digital repeater inputs
51.620-51.980	Repeater outputs (19)
51.620-51.680	Digital repeater outputs
52.000-52.480	Repeater inputs (23)
52.020, 52.040	FM simplex
52.500-52.980	Repeater outputs (23)
52.525, 52.540	FM simplex
53.000-54.480	Repeater inputs (19)
53.000, 53.020	FM simplex
53.1/53.2/53.3/53.4**	Radio control**
53.500-53.980	Repeater outputs (19)
53.5/53.6/53.7/53.8**	Radio control**
53.520	Simplex
53.900	Simplex

**Optional, local choice

Amateur Radio Via Satellites

Andy MacAllister WASZIB
14714 Knights Way Drive
Houston TX 77083

New Satellites

The flight of Ariane V-59 was originally scheduled for September 1st. The primary payload, SPOT-3, encountered technical difficulties requiring a launch slip to late September. If all goes as planned, six smaller satellites will be mounted on a ring at the base of SPOT-3. They include Stella, Healthsat, PoSat-1, Itamsat-A, Kitsat-B and Eyesat-A. Two of the satellites are purely commercial, two contain both commercial and amateur payloads, and two are dedicated to amateur radio service.

The ejection sequence has SPOT-3 separating first, followed by Stella, Kitsat-B, PoSat-1, Healthsat, Eyesat-A and Itamsat-A. The OSCAR (Orbiting Satellite Carrying Amateur Radio) numbers associated with the new satellites are currently under discussion since Arsene has not yet been given the name Arsene-OSCAR-24. If Arsene is given a number, the suggested OSCAR numbers for the new hamsats are: Kitsat-OSCAR-25, PoSat-OSCAR-26, AMRAD-OSCAR-27 and Itamsat-OSCAR-28. The expected orbit of the new satellites is 300 km high with an inclination of 38.7 degrees. This is identical to that of the microsats, OSCARs 14-19.

Stella and Healthsat are the commercial secondary payloads. Stella is a German geodetic satellite and Healthsat is a test platform for small ground-station activity in support of efforts by VITA (Volunteers in Technical Assistance) and Sattelite. It is a digital system that operates at 9.6 and 38.4 kbps (kilobytes per second).

The combination amateur/commercial satellites include PoSat-1 and Eyesat-A. PoSat comes from the

Portuguese organization LNETI. The satellite's purpose is to provide experience to Portuguese nationals for the construction and operation of satellites.

PoSat-1 was built at the University of Surrey in England by members of the UoSat team and a group of four engineers from Portugal. The satellite carries an earth-imaging camera capable of 200 meter resolution, a CCD (charge-coupled device) camera as a star sensor, a cosmic-ray detection experiment, a Trimble GPS (Global Positioning System) receiver and a DSP (Digital Signal Processing) experiment with two Texas Instruments processors. PoSat-1 will support 9.6 and 38.4 kbps operation on the amateur band frequencies. The primary amateur activity will likely involve the imaging experiment. Note Table 1 for details.

Eyesat-A is the first commercial satellite built on a microsat bus structure. It was manufactured by Interferometrics, Inc. of Vienna, Virginia. The amateur radio portion of this satellite was produced in cooperation with AMRAD, an experimentally-oriented organization in the Virginia suburbs of Washington, D.C. The satellite is capable of digital communication speeds from 300 to 19.2 kbps on the amateur bands. Although Table 1 shows operation only up to 9.6 kbps, onboard experiments can be initiated for operation above this. A crossband voice repeater with 70cm uplink and 2 meter downlink is also a possibility.

Kitsat-B and Itamsat-A are the two satellites dedicated to amateur-radio service to be carried aloft on the Ariane V-59 mission. Both satellites promise to be extremely popular additions to the current fleet of digital hamsats.

Kitsat-B is the second satellite from KAIST (Korean Advanced Insti-



Photo A. Dick Jansson WD4FAB attended the AMSAT-UK meeting to present data on the new structure for the Phase-3-D satellite. (WSIU photo.)

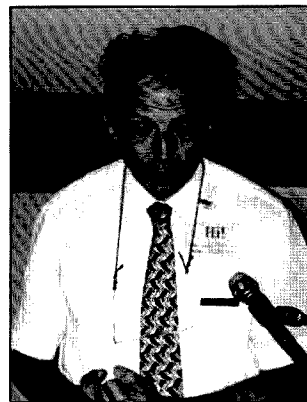


Photo B. Viktor Kudielka OE1VKW discovered the orbital mechanics responsible for the eventual decay of AMSAT-OSCAR-13's orbit. (WSIU photo.)

tute of Science and Technology). While the first one, now known as Kitsat-OSCAR-23, was built at the University of Surrey and is based on the Surrey satellite frame, Kitsat-B is a completely Korean effort. This represents an important phase in the technology transfer between Surrey and KAIST. The new Kitsat carries many of the same type payloads as K-O-23, but has advancements in imaging capability and data transfer speed. More information on the scientific components of Kitsat-B can be found in the June "Hamsats" column. Operating frequencies are shown in Table 1.

Itamsat-A was built by AMSAT Italy and incorporates modifications and advances to the original microsat design. These upgrades have been used to modify designs for additional hamsats under construction in other parts of the world. While data communications rely primarily on the PSK (phase-shift keyed) modulation techniques of the current microsats, a 9.6 kbps system using FM up and down has been incorporated for compatibility with the highly successful UoSat and Kitsat designs now in orbit.

Future Satellites

In addition to those hamsats scheduled for the V-59 launch, UN-AMSAT from Mexico and RS-15 from Russia are ready and waiting for their flight to space. CESAR-1 from Chile, SUNSAT from South Africa, HUTSAT from Finland, Sedsat from the U.S., Guerwin-1/Techsat from Israel and the International Phase-3-D project are under construction.

Details of these efforts and discussions concerning operations via the current group of operational hamsats were a significant part of the 1993 AMSAT-UK Colloquium. The meeting was held at the University of Surrey in late July and early August. Many well-known satellite designers and builders attended and presented papers detailing current and future efforts. Nearly 140 delegates from six continents exchanged views and stayed in touch with current findings and advancements relating to the new and future satellites.

Dick Jansson WD4FAB from AMSAT-NA detailed progress with the structural design of Phase-3-D. Viktor Kudielka OE1VKW described the causes for the eventual decay of

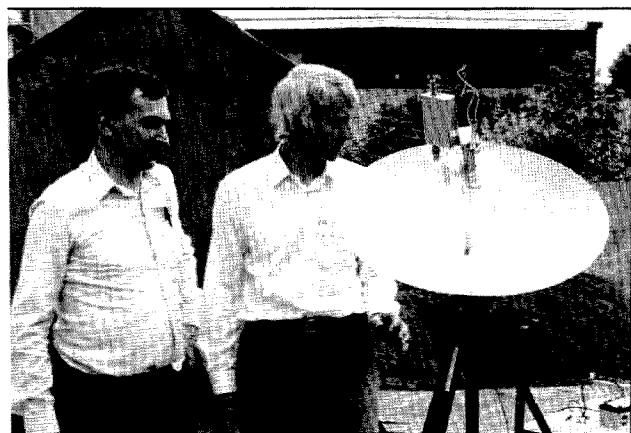


Photo C. Freddy De Guchteneire ON6UG and James Miller G3RUH demonstrated small dish for 2.4 GHz amateur satellite reception at the AMSAT-UK meeting. (WSIU photo.)

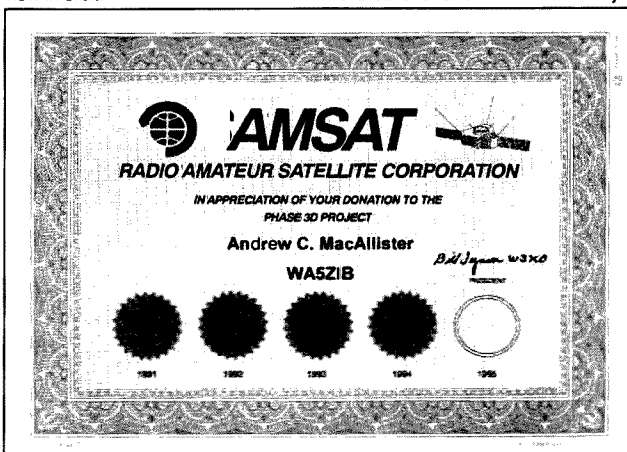


Figure 1. AMSAT certificate awarded for financial support of the Phase-3-D amateur radio satellite project.



Photo D. A close-up of the G3RUH Mode "S" receive system. (W5IU photo.)

AMSAT-OSCAR-13's orbit and the need for caution planning the path of Phase-3-D. Other noteworthy talks included one on radio astronomy, descriptions of the transmitters and receivers to be carried on Phase-3-D and Mode "S" (2.4 GHz receive) efforts by James Miller G3RUH.

Table 2 shows the new designations relating to satellite frequency bands to be used on Phase-3-D. The satellite will use a matrix of separate transmitters and receivers and thus does not call out transponders that use specific uplink and downlink combinations. Thus Mode "B" (70cm up and 2 meters down) would be

called Mode "UV" where the first letter describes the uplink and the second is the downlink. Innovative additions to Phase-3-D include a 5.654 GHz uplink, a 40 watt 10 GHz downlink, a new digital system called RUDAK-3 from Germany and a Japanese three-camera system with digital downlinks. All the transmitters for the new satellite are designed for much easier reception on earth.

James G3RUH gave a live demonstration of A-O-13 Mode "S" reception with his 60cm dish to show how easy microwave reception can be. A complete description of the construction of the small dish with

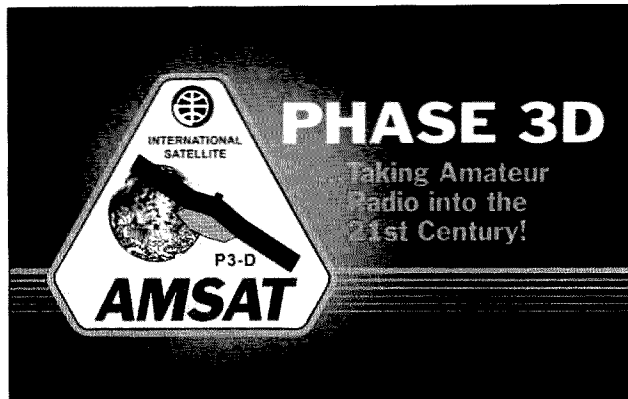


Figure 2. ARRL QSL sent in recognition of donations for Phase-3-D, sent via the American Radio Relay League.

helix feed was printed in the March/April issue of *The AMSAT Journal*. He also presented his 16-turn, 2.4 GHz helix used for direct A-O-13 "S" reception without a dish. Tests have proven that the small antenna is an adequate performer when used in conjunction with a low-noise preamplifier and a good converter system. James reminded those attending his talk that the effective radiated power at 2.4 GHz for A-O-13 is only 5 watts. Signals from Phase-3-D at 2.4 GHz should be somewhere between 5-20 kilowatts. This 30-36 dB signal increase means that the small helix is significant overkill. A quarter-wave whip (about an inch long!) should work just fine for Phase-3-D.

Support for Phase-3-D

All the incredible capabilities slated for Phase-3-D come at a price. This will be the largest, most comprehensive and expensive amateur radio satellite to date. The program needs money in addition to the donated parts and labor.

AMSAT-NA has been promoting

the project and raising funds for several years. A special contribution program based on yearly donations over a five year period started in 1991. With a minimum contribution of \$36.92, AMSAT will reply with a special Phase-3-D certificate with one sticker. Additional donations of at least \$36.92 each, bring more endorsement stickers to fill out the years from 1991 through 1995, when AMSAT hopes to launch Phase-3-D. AMSAT can be contacted via phone at (301) 589-6062 or by mail at 850 Sligo Ave. #600, Silver Spring MD 20910.

The American Radio Relay League launched a program in June with a mailing to all ARRL members briefly describing the Phase-3-D project and proposing an ARRL goal to raise \$300,000 from League members. Every contribution to Phase 3-D made through the ARRL is acknowledged with a unique QSL to serve as a permanent confirmation of support. The ARRL can be reached at 225 Main Street, Newington CT 06111. Be sure to mark any donations to the attention of Phase-3-D.



Photo E. Two AMSAT-UK meeting attendees inspect the G3RUH 16-turn helix for Mode "S" reception from AMSAT-OSCAR-13. (W5IU photo.)

ITAMSAT-A:

Downlink 435.867/435.822 MHz (435.867 MHz primary)
Uplink 145.875/145.900/145.925/145.950 MHz
Speed 1200/4800/9600 baud

KITSAT-B:

Uplink 145.870/145.980 MHz
Downlink 435.175/436.500 MHz
Speed 9600 baud

EYESAT-A:

Uplink 145.850 MHz
Downlink 436.800 MHz
Speed 300-9600 baud (19.2 kbps downlink possible)

POSAT:

Uplink 145.925/145.975 MHz
Downlink 435.250/435.275 MHz (435.250 MHz primary)
Speed 9600 bps (38.4 kbps likely)

Table 1. Frequency plans for the V-59 hamsats.

145 MHz Band V	1.2 GHz Band L	5.6 GHz Band C
435 MHz Band U	2.4 GHz Band S	10 GHz Band X

Table 2. New satellite mode designations for Phase-3-D.

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Magnet Circuit Correction

I hate to do this, but I am going to ask all of you to take your seats, get out your notebooks, and turn back a few sections to the notes you took on this column a few months ago. You didn't take any notes? Shame on you, now you'll have to go get the magazine itself. Why do I ask such a thing? Because there is a mistake in a schematic, and I don't want anyone tripping over it!

In the August 1993 edition of "RTTY Loop," I printed a selector magnet circuit designed by Bob Roehrig K9EUI. Unfortunately, somewhere along the line, a part of the diagram entered the great bit bucket in the sky. The corrected portion is shown in Figure 1. Without the missing resistors (R7 and R8), the keyboard will short out the 120 volt supply. So, get out your notes or magazine, and pencil in the correction NOW! You never can tell when you might decide to use this versatile circuit, and I'd hate to see you ruin a perfectly good power supply.

Digital Communications Terms

Moving right along, here's a letter from Bob Workman WA4ZZN of Atlantic Beach, North Carolina, which yifies the confusion which besets the ham entering digital communications. There are computer programs which simulate a TNC, and there are TNCs which require some kind of terminal, and there are terminal units which are needed by TNCs or programs to work. Bob needs clarification of this whole confusing mess of terms.

We need to begin somewhere, so let's start with some information encoded in digital pulses. These may be off a loop supply from a mechanical eleprinter or from a computer. These individual letters or characters need to be formed into the packets needed for packet radio communications. This is the function of the device commonly called a TNC, or Terminal Node Controller. Having formed those packets, the next step is to impress the packets of data onto a radio signal. This is done by some form of frequency shift keying, either audio frequency shift keying (AFSK) or radio frequency shift keying (FSK)—the former being used on VHF, the latter on HF. Reception is accomplished by receiving the frequency shifted signal, taking the audio output and converting it to on-off digital pulses through a demodulator or terminal unit, and then allowing our TNC to disassemble the packets and reproduce the desired communication.

Since conventional RTTY has no

need for packet assembly or disassembly, a TNC is not used for this mode, only a terminal unit for reception. Some of the terminal units which have gained popularity in recent years are the HAL Communications ST-5, ST-6, ST-5000, and ST-6000; Flesher TU-170; and many, many others.

While many hams use TNCs which are small circuit boards external to the terminal or computer, there are programs available for many computers which can create a TNC in software. For these systems, all you need is a radio interface, which may be affected by a terminal unit originally designed for RTTY only.

Conversely, there are many controllers on the market which integrate the TNC and terminal unit—let's call that a modem to more accurately reflect the transmit (modulate) and receive (demodulate) capability of these devices—into one box. Popular units from MFJ, Kantronics, and AEA can be seen in ads in this magazine.

Now, in the near future I hope to run information on modifying the Flesher TU-470 to run with some of the software TNCs. The clear answer is that it can be, and is being, done by many hams. This may well represent one of the most economical ways to get onto packet and, with some of the programs around, RTTY and even AMTOR, too! Thanks for the question, and good luck with the endeavor.

Model 42

Having corrected one, and answered one, now it's time to toss it out to you guys. I have a letter here from Eugene Matthews W0UAW from Topeka, Kansas. He writes, "I just acquired an almost new Model 42 Teletype (RO) machine, with power supply. I cannot find anyone who knows anything about this Model 42. I want to use this for hard copy. I need to know what connections to use to hook it up so it will print. Also, what current and voltage does this machine take to operate the selector magnets? The power supply is transistorized and must be 12 VDC output. What is the speed of this machine?"

Well, Eugene, the Model 42 is the end of the Baudot line, as far as I know. With a dot matrix output, it was able to accept TTL, current loop, or RS-232 interfacing. I believe that tape equipment was also available for this model. There was also a Model 43, which was the ASCII version of the Model 42. Buffered versions of this machine were available that could run at higher speeds.

I have no diagrams or specifics on the Model 42 or Model 43, but, somehow, I trust that someone out there in 73-land will share some with us, real soon! Watch future columns for the in-

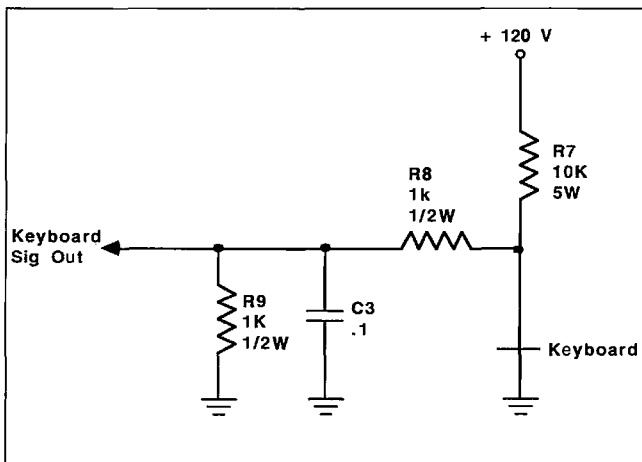


Figure 1. Selector magnet correction.

formation, as soon as it surfaces.

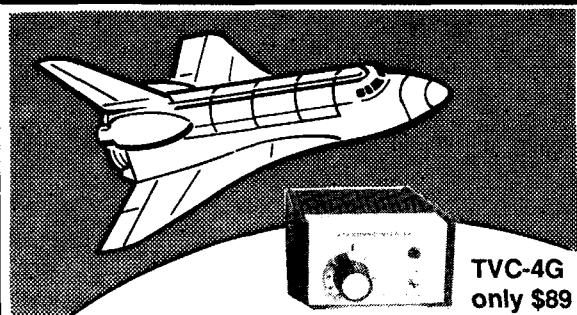
Along those lines, folks, here's a question from me to all of you. I have been looking, very unsuccessfully, for the round, six-pin mike connector for my Satec HT-1200 transceiver to try to get it up onto packet. If anyone has located a connector, and wiring information for this antique, I would appreciate hearing from you!

Feel free to contact me for this, or any other related (or non-related) matter at the address above, or on Com-

puServe at 75036,2501, Delphi at MarcWA3AJR, or America Online at MarcWA3AJR. I look forward to your comments and questions, and yes, the various software collections are still available. Send an SASE for the list, or inquire via Email and I'll Email a response back to you. A look at that Flesher modification next month, and maybe a look way, way, back, too! Suspense? I can't stand it. Just don't let your subscription to 73 lapse! You might miss RTTY Loop!

73

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More on the Boyd Sweeper

In the September column we looked at the Boyd Electronics RF sweep generator kit. This low-cost device provides CW, Symmetrical Sweep and Video modes. The CW mode operates like a regular signal generator, i.e. it outputs a single frequency for each setting of the 2-30 MHz frequency control. The symmetrical sweep mode is a variable-width swept frequency mode; the width of the swept portion is a function of the front panel settings. The video mode sweeps the entire HF range for every cycle of the sawtooth sweeping signal. In the original column I promised to discuss in the very next month's column add-on circuits that make the generator better. I didn't exactly lie, but other things came up that prevented me from putting that column together on time. This month, we'll keep that promise.

Three obvious improvements for any sweep generator project, including the Boyd unit are: an external step attenuator, a frequency translator for lower frequencies, and a marker generator.

The step attenuator is needed because the sweep generator outputs a rather large signal level . . . too large for easy testing of receivers and amplifiers in most cases. While the signal level will work well with some tuned circuits and filters, it is inappropriate for nearly any application that has amplification associated with it. A step attenuator (Photo A) provides switch-selectable levels of attenuation that can be in or out of the circuit as needed. In addition, the step attenuator will provide a swamping effect between the signal generator and the circuit under test in case the impedance of one or the other is not 50 ohms, or varies somewhat.

A frequency translator is needed because the Boyd sweep generator doesn't cover frequencies below 2 MHz. This limitation does not affect all hams because the IF frequencies in our HF rigs tend to be 8.83, 9.0 or 10.7 MHz . . . well within the range of the Boyd RF sweeper. But for those who need to sweep circuits below 2 MHz, including the once-standard 455 kHz IF frequency (used on Collins mechanical filters, even today), we need to be able to translate the Boyd sweeper's output to

a lower frequency. We need a double-balanced mixer (DBM) and a crystal oscillator.

The marker generator is a standard crystal oscillator that allows known frequencies to be injected into the circuit for the purpose of calibrating certain spots on the band. For example, if you use a 9.0 MHz IF in your receiver, you might want to have a 9.000 MHz crystal oscillator to mark the spot on the oscilloscope presentation of the sweeper signal.

Step Attenuator

A step attenuator such as Photo A consists of several stages of pi-pad resistor networks, each of which can be switched into or out of the circuit with a DPDT switch or relay (Figure 1). Table 1 shows the values of resistors needed in the pi-attenuator for various popular levels of attenuation. Alternatively, if you want the attenuator to be a little more precise, then use Mini-Circuits AT-series fixed attenuators. These devices are designed to fit onto printed circuit boards and perf boards on the standard 0.100-inch center holes. The type number, AT-x, is formed by replacing the "x" with the level of attenuation desired; e.g. AT-1 is 1 dB, AT-6 is 6 dB, AT-10 is 10 dB, AT-12 is 12 dB, and AT-20 is 20 dB.

In order to obtain higher orders of attenuation, one need only series connect several lower order stages. For example, to obtain 40 dB attenuation, cascade two 20 dB attenuators, or a 20 dB and two 10 dB attenuators.

In some cases, you might want to use a barrel attenuator. These attenuators are in-line, fixed attenuators that have a male coaxial connector on one end and a female coaxial connector on the other. They can be placed anywhere in the transmission line from the signal source to the circuit under test, although in most cases the preferred location is right at the signal generator output. The attenuator male connector is attached to the RF output connector of the signal generator, while the coaxial transmission line to the load is connected to the female connector on the attenuator. These devices are also available from Mini-Circuits, but at somewhat higher cost than the printed circuit variety.

One thing that you must do when building a multistage step attenuator is to use real good shielding between successive stages. Any signal leakage

around the circuit detracts from the attenuation value selected. The ARRL Handbook for Radio Amateurs for most years has an attenuator project. In one version of that circuit, pieces of copper-clad printed circuit blank material is used to fashion the walls and sides of the step attenuator compartments . . . and only one stage is inside each compartment. You can also use brass stock from hobby shops to fashion the walls and sides of the step attenuator compartments . . . and only one stage is inside each compartment. You can also use brass stock from hobby shops to fashion the walls and sides of the step attenuator compartments . . . and only one stage is inside each compartment. You can also use brass stock from hobby shops to fashion the walls and sides of the step attenuator compartments . . . and only one stage is inside each compartment. You can also use brass stock from hobby shops to fashion the walls and sides of the step attenuator compartments . . . and only one stage is inside each compartment.

Frequency Translator

A frequency translator to make the RF sweeper work below 2 MHz is relatively easy to build. The Mini-Circuits (P.O. Box 350166, Brooklyn NY 11235-0003) passive double-balanced mixers such as the SRA-1, SBL-1 and SBL-1-1 are easily obtainable, and well-behaved (i.e. they do what they are advertised to do). We've discussed these devices in this column previously.

You can also use the Signetics NE-602 double-balanced mixer IC device for the translator. The NE-602 contains a Gilbert transconductance cell DBM and a local oscillator stage, and has been covered previously in these pages.

Four features are needed to make the translator work in this context: a mixer device, a crystal oscillator, a high-pass filter terminated into a 50 ohm dummy load, and a low-pass filter that carries the output signal. The filters are necessary because the output of the DBM will be the sum and difference of the RF sweeper and crystal oscillator signals ($F_1 + F_2$ and $F_1 - F_2$). The sum frequency is not needed, so it is passed through a high-pass filter to be absorbed in a 50 ohm dummy load (actually, a 51 ohm resistor will do). The difference frequency is passed through the low-pass filter to a 50 ohm output terminal. It is probably smart to use a matched amplifier at the output of the low-pass filter because the mixer and the low-pass filter have insertion losses associated with them, and an amplifier

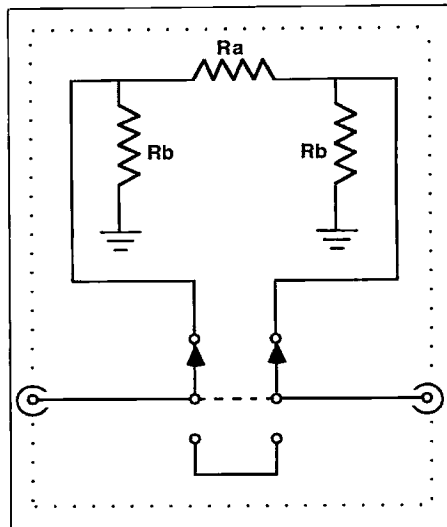


Figure 1. Switchable attenuator stage (see Table 1 for values).

will make up for that loss.

Figure 2 shows a circuit that can be used for this purpose. The RF sweeper input signal is fed to pin no. 1 of the DBM, which is its RF input. This signal must be kept below +1 dBm or the mixer might suffer harm. A series -3 dB attenuator is used to reduce the signal level. Even if the signal level is below the +1 dBm level, some people like to use the attenuator anyway because it provides a "swamping" effect against impedance variations. In those cases, a 1 dB attenuator can be used. Keep in mind that, for situations where the impedances are constant and the signal level is within range (below +1 dBm), the attenuator is optional.

The local oscillator circuit is a standard crystal oscillator circuit with an output amplifier to boost the signal level. Ordinary NPN silicon transistors can be used (2N2222, 2N4401, 2N3904, etc.) The mixer likes to see local oscillator signals in the +7 dBm range for proper conversion, which means, at 50 ohms, 5 mW power level or a peak-to-peak voltage of 700 mV. The crystal chosen can be anything in the 2 to 10 MHz region, so long as you can adjust the sweep generator to be within the difference frequency of the lowest sweep generator output frequency. I chose a 6 MHz crystal because it is one of the standard "microprocessor clock" crystals available at low cost from local parts sources. Crystal suppliers can make any exact frequency you need, or you can use one of the computer clock standard frequencies, or a 3.579 MHz color TV "color burst" crystal . . . all at low cost.

The output filters can be easily made from toroid coil forms or, if you prefer, standard coils obtained from parts suppliers. If you opt to use the toroidal cores, then use T-50-2 (RED) cores. These devices have an AL value of 49, so the following turns counts will suffice:

L1,L2	3.14 μ H	25 turns
L3,L5	4.9 μ H	32 turns
L4	8.5 μ H	42 turns

The capacitors in the filter should be either silver mica or NPO ceramic devices, with the latter being preferred over

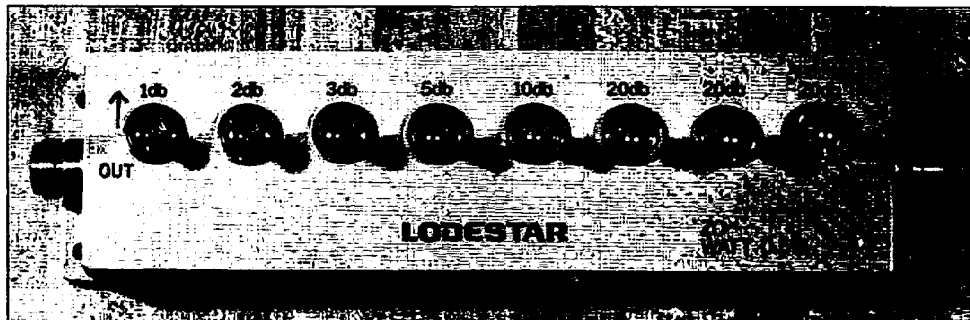
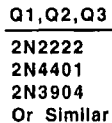


Photo A. Commercial step attenuator.



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HOMING IN

Number 12 on your Feedback card

Joe Moell P.E. KØOV
PO Box 2508
Fullerton CA 92633

Motorized Beams, Santa Barbara Style

One reason that VHF hidden transmitter hunting is a growing activity for ham clubs is that it's inexpensive to get started. You can go on foxhunts or T-hunts (as these events are called) with the 2 meter radio you have now, if it has an S-meter.

A quad, yagi, or other radio direction finding (RDF) antenna is cheap, especially if you make it yourself from PVC pipe and wire or from scrap TV antenna tubing. Add an RF attenuator made from some toggle switches, carbon resistors, and copper-clad board, mount the beam on your car, and you're set. Such a setup is more than adequate to win many hunts, with practice.

However, like participants in any other sport, T-hunters are always looking for an advantage over the competition. Decades ago, they discovered that a polar display of signal strength versus direction gives a much better

Radio Direction Finding

understanding of signal characteristics than an S-meter alone, particularly when hunting among tall buildings or hills that bounce and scatter 2 meter signals.

"Homing In" covered theory and advantages of polar displays in detail with actual trace photos in October 1992. KK6CU's home-brew mobile implementation of the scheme was featured in the following issue, complete with motorized quad and storage scope indicator. Now two T-hunters from Santa Barbara, California, have found a way for penny-pinching tinkers to have a polar display and motorized beam without the expense of a storage monitor and the hassle and noise of RF slip rings.

Look! No Slip Rings!

Tom King KA6SOX works in marine electronics at the Santa Barbara harbor. Kerry Provancha KK6OS enjoys mechanical engineering challenges. Together, they created the RADAD, which stands for "Radio Detection And Direction" (see Figure 1). As passers-by admired it at a recent ham radio swap meet, I interviewed them and



Photo A. Kerry Provancha KK6OS brought the RADAD to the TRW swap meet and unscrewed the covers to reveal the antenna turning mechanism.

they eagerly told me how it came about.

KK6OS: "We were looking for a long persistence phosphor cathode ray tube (CRT) display, rather than a storage scope, because a storage scope needs to be cleared all the time."

KA6SOX: "I happened to get some junk marine radars. The magnetron transmitting tubes had croaked or the high voltage boards had gone up in flames. They're economically unrepairable for marine service because I

can't get tubes or power supplies a reasonable cost. Fortunately, those parts aren't needed for RDF."

KK6OS: "Of course, the microwave transmitter, receiver, and horn antenna were of no use, but we retained the rest of the radar essentially intact. We changed the antenna drive motor because we wanted different rotation speeds (see Photo A)."

KA6SOX: "Sometimes we want to paint the RDF picture slowly and sometimes fast, depending on what the hider is doing. So we used a 31

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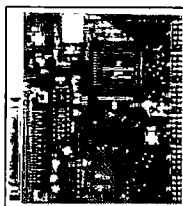
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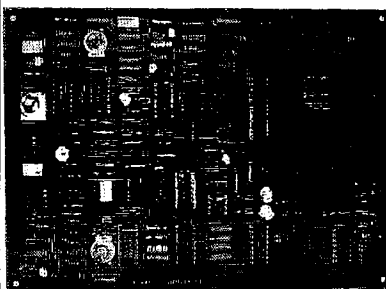


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Photo B. The RADAD display unit mounts on the floor hump. Tom made a new front panel and mounted the RF attenuator box on a bracket for easy access.

volt DC motor and built a variable voltage inverter to control speed."

KK6OS: "It's difficult to find motors with adequate torque over a wide speed range. We use a DC gearhead type about 5 inches long, about 100 rich-lbs. torque."

KØOV: "How did you make the 'adar scope show 2 meter bearings?'"

KA6SOX: "It was very simple. All the CRT power supply and sweep circuitry is already there (see Photo B)."

KK6OS: "The electronic yoke in the display follows a resolver, which is geared to the antenna (Photo C). Whatever speed the resolver goes, the yoke on the CRT follows exactly. There is no mechanical stuff in the yoke."

KA6SOX: "As the antenna turns, the yoke sweeps the CRT electron beam in a circle. In addition, the radar control head generates a linear voltage ramp that sweeps the beam from

screen center toward the edge at about 200,000 times per second."

KK6OS: "We compare receiver S-meter voltage with the ramp voltage. The comparator triggers a one-shot to produce pips, replacing the radar pulse. It pulses the CRT cathode negative for 1.5 microseconds. The S-meter voltage compared against the ramp determines how far out on the screen from the center you get pips. The resolver tells where on the azimuth circle to put the pips."

KØOV: "So at 200,000 pips per second, it looks like a continuous line is being drawn on the screen."

KA6SOX: "Right. Full scale on the S-meter equals maximum deflection to the edge of the screen. The interface was done with one LM339 quad op amp IC."

KØOV: "What about your antenna design?"

KA6SOX: "We went through about a half dozen iterations of the antenna."

KK6OS: "We tried to make one that would fit inside the radar's plastic radome so there would be no wind-loading. But it was a negative gain antenna without a decent pattern. It would probably work on 450 MHz, but not on 2 meters."

KØOV: "So you made a full-sized 2 meter beam to get good sensitivity?"

KA6SOX: "Yes. We solved the rotary joint problem by using an AEA half-wave whip antenna as the fixed-

mounted driven element. The directors and reflectors rotate around it. It gives a beautiful pattern."

KK6OS: "There are no slip rings. The driven element mounts on a BNC that never rotates, so it's noise-free (see Photo D). The coax goes right up through the center of the waveguide where the radar output used to be. The antenna is a three-element yagi, made of a PVC pipe upright and crossbar. Two directors and a trigonal reflector rotate around the driven element. It's all painted stealth black and sits on a rack that bolts to the car-top carrier (see Photo E)."

KØOV: "Was the trigonal reflector used for a better pattern or for mechanical balance?"

KA6SOX: "Both. We had a single reflector at first. When we changed to the trigonal reflector, the lobes on each side dropped by 5 dB and the back lobe completely disappeared. We measured 0.7 dB more gain, too."

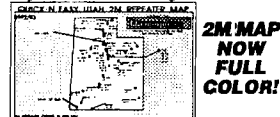
KK6OS: "Now the antenna was mechanically balanced almost perfectly."

KA6SOX: "But we discovered that mechanical balance is not the same as windload balance. Even with the triple reflector, when we were going down the road at 40 MPH, it would stall. We then added a small fin on the back. Now we can drive up to 55 MPH with no problems."

KØOV: "How do you shrink the display size as you close in?"

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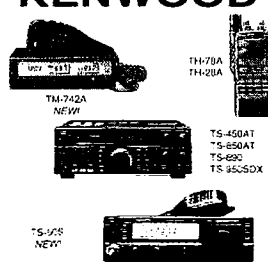
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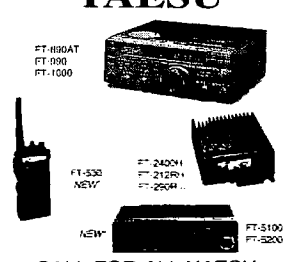
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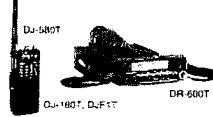
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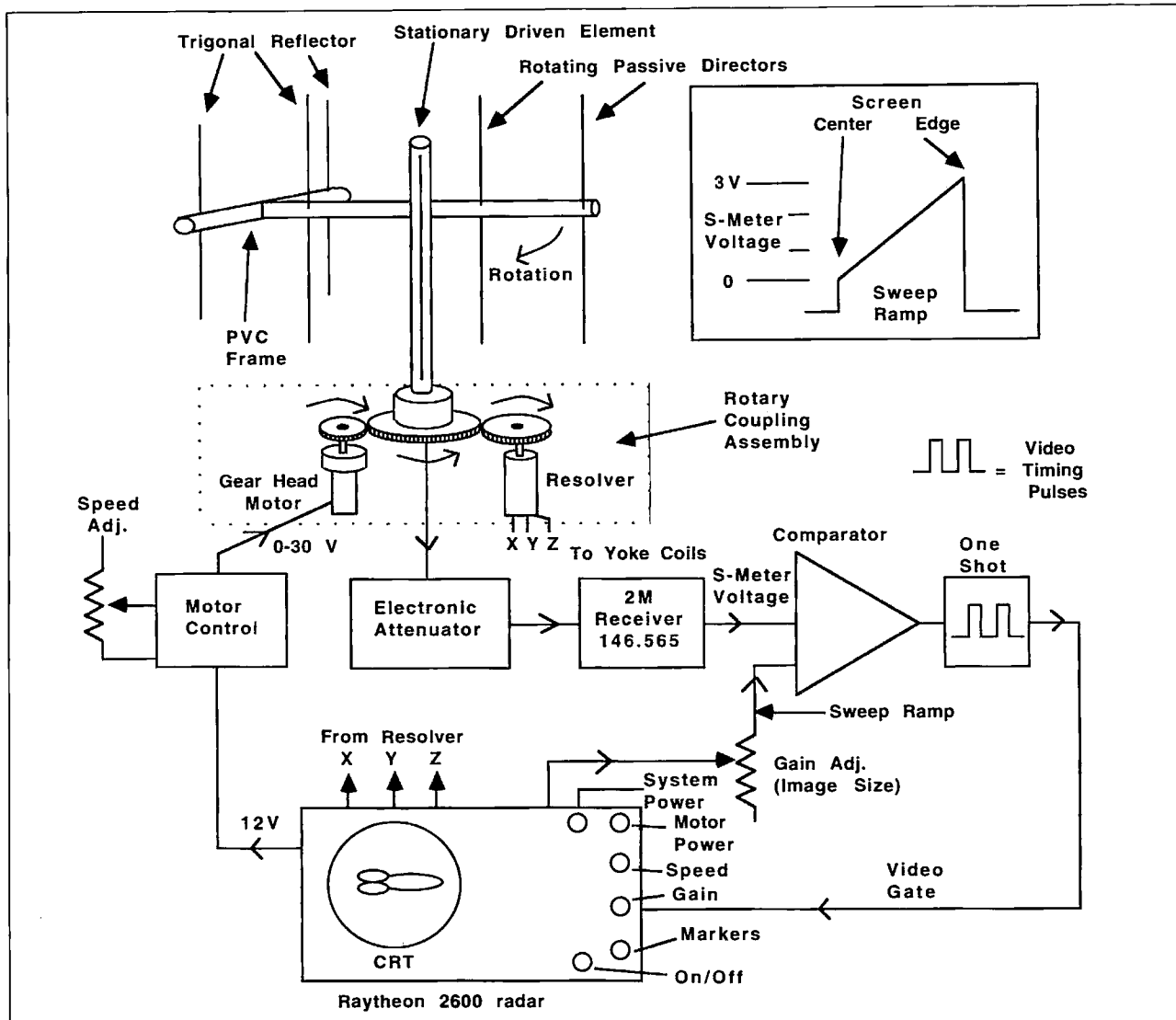


Figure 1. The RADAD is made from a defunct marine radar display unit and rotary coupling assembly, added to a 2 meter receiver, attenuator, and PVC pipe yagi.

KA6SOX: "With an RF attenuator. It's based on the offset attenuator in QST for November 1992. We changed

the offset to 1 MHz and use a crystal-controlled oscillator, plus better shielding."

KK6OS: "The continuously variable electronic attenuator has been the biggest single improvement to the whole system. It makes it easy to keep the display on screen. Before that, we used a switchable resistive attenuator, which was hard to use because of the large step sizes."

KØOV: "Tell me about hunts in Santa Barbara."

KK6OS: "We have all kinds, including mileage hunts (lowest odometer miles wins), time hunts (first finder wins), and combination time/mileage hunts. The hider decides. Most are time-only. We hunt on the fourth Saturday night of the month on 146.565 MHz."

KA6SOX: "A few months ago, the hiders wove the antenna inside a volleyball net at the beach. They used RG-174 coax, painted the color of the volleyball tape along the bottom. It was then painted yellow along the pole all the way down into the sand, where the transmitter was buried, running about 50 watts. I'm pretty sure

the vertical pole was a non-tuned reflector. We found the general area easily, and the hiders were sitting right there roasting wieners. The big problem was finding the antenna and the radio."

KA6SOX: "Some T-hunts in Santa Barbara have become absolutely insane. They're not like Los Angeles All-Day hunts, where the T is miles and miles away. But dirty tricks by the hiders are allowed. They do all kinds of weird things, like swinging beams and hiding multiple T's."

KK6OS: "I started it, I guess. On one hunt, we synchronized two transmitters. When one came on, the other one went off, and so on. They were on two different mountaintops. We were trying to screw up the Doppler users so they would get an indication that went this way, then that way. My former T-hunt partner has the control box for the synchronized T's and he likes to use it. Other hams have come up with their own schemes for doing it too."

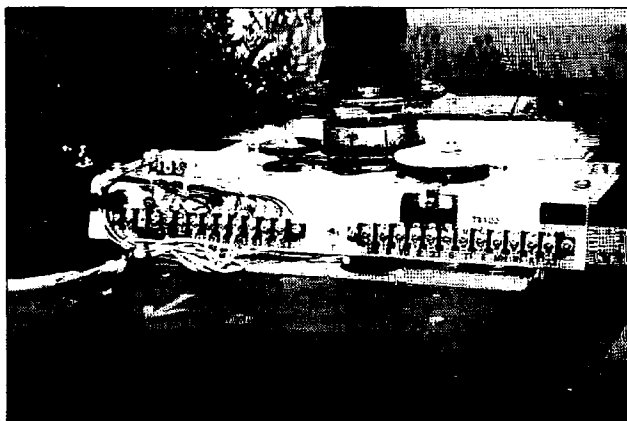


Photo C. The 30 VDC motor is geared to the rotating antenna mast and the resolver. Inside the mast is the old waveguide, which holds a stationary driven element.



Photo D. Marine radar technician Tom King KA6SOX has taken off the yagi frame with parasitic elements and is holding the top of the driven element whip.

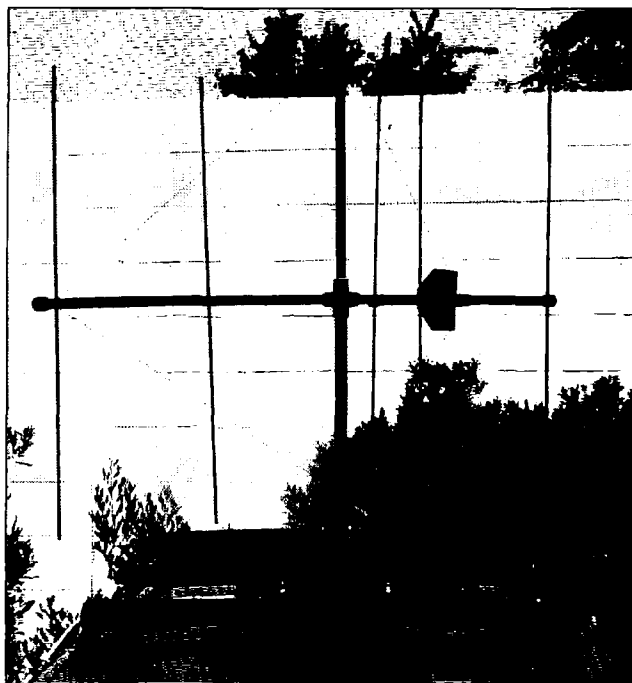


Photo E. This lightweight vertical yagi with trigonal reflector has good gain and an excellent pattern, yet spins up to 140 RPM while the car moves at 55 MPH.

KA6SOX: "Sure, but who knows how many are still in service and how many are at the bottom of the ocean! They have longer service life than most radars of the '70's because they don't have a rotating yoke assembly to fail. There are probably 35 or 40 still in use on the thousand or so boats in Santa Barbara harbor. I saw a used one being installed on a boat about three weeks ago."

Let's Try It

After the swap meet, I rode along as Tom and Kerry demonstrated the RADAD on a beginners' hunt sponsored by the TRW Amateur Radio Club. The system worked smoothly and quietly, giving excellent scope patterns. In just a few minutes, we arrived at a parking lot where the hidden signal was super-strong.

None of us had brought "sniffing" equipment, so I tuned to the third

harmonic of the hidden T signal with my dual-band handheld, got a bearing by body shielding, and started walking. Five minutes later, I tracked down the antenna 15 feet up in a tree.

Tom and Kerry have found a simple, yet elegant scheme for feeding a continuously rotating beam. Waterproofing is easy and there are no slip rings to make noise or cause losses. The main disadvantage is that only vertically polarized yagis can be fed in this manner, a problem in areas where hiders are allowed to use horizontal polarization.

You can't buy a RADAD, but if you're a knowledgeable builder, you can assemble a similar system. With careful scrounging, you'll preserve your T-hunting gasoline fund. It's time to hit the swap meets and make friends with your local marine electronics tech!

73

K0OV: "Have you won any hunts with the RADAD?"

KK6OS: "I won with it in June, so I hid in July. When I hid, I used the spinning RADAD antenna in a parking garage downtown. I set the antenna unit on the floor at a middle level of the garage, rotating at 20 RPM. I transmitted 5 watts SSB modulated with a pulsed 500 Hz tone, a quarter second on, then a half second off. I was trying to make the Doppler RDFs go wacky. It didn't do that, because one guy found us in 15 minutes. But another hunter ended up dozens of miles away in the wrong direction from he start, and three teams gave up without finding it."

K0OV: "So your system does a great job finding tough T's, right?"

KA6SOX: "It's still experimental. We don't consider it to be a breakthrough, but it's quite a step forward in distinguishing what is a signal reflection and what is not, which the Doppler cannot do when the two are equal in level. However, it requires a skilled operator to interpret it."

KK6OS: "Up here in Santa Barbara, hunters often pulse the signal. If they flicked just the right pulse rate and our antenna was going at just the wrong speed, the CRT screen became useless. On a couple of hunts, I was pulling my hair out. I could not get a bearing, because they were pulsing exactly three times for every rotation of the unit. Since then, we changed the motor control to cover 0 to 140

RPM. With the long persistence P7 CRT at night, you can see 15 to 20 traces superimposed at 140 RPM."

K0OV: "What radar models do you recommend for readers who want to make their own RADAD?"

KA6SOX: "Models 2600 and 2800 are the best. Raytheon designed and imported them, but they were made by Japan Radio Corporation. They're also known as the Mariner's Pathfinder. They were produced between 1970 and 1976. Raytheon sold 35,000 of the 2600s worldwide, and around 8,000 of the 2800s.

K0OV: "Are these radars available?"

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The Invention Connection

In the July 1992 edition of *73 Amateur Radio Today*, I wrote a column called "Invention Versus Innovation." I discussed different techniques a teacher can use in the classroom to help children develop inventive thinking skills. Amateur radio in the classroom allows the teacher to bring out the very best in creativity and analytical skills in the students. I received an excellent response to this column from other teachers who shared their experiences with me after following some of the suggested activities.

One of the interesting letters I received was from William L. Enter, Sr., KB5NUA, founder and past president of the "Invention Development Society, Inc." He points out that inventing is a prized human trait. It sets one apart from others in a unique way. Few people develop their ideas to the practical stage and still fewer to the patenting stage. Congress created the Patent

Office in 1836, yet the five millionth patent was granted only last year.

William holds three U.S. patents and has invented at least 58 electronic circuits. He says there are many opportunities for young minds to benefit from an invention program. "We could use some new electronic circuits," says William.

He has been working with the Oklahoma Student Inventors Exposition since April 1982. This program is designed for grades K-12. Statewide participation has annually been as high as 4,428. The organization teaches teachers how to teach thinking skills and problem-solving skills to their students. The students learn to do analytical thinking and creative problem-solving on a daily basis in all subject areas. The children are then required to research their community for an unmet need and to invent something which serves that need. They must produce a novel response that solves the problem at hand. Their inventions must be a simple, elegant, aesthetic solution to a real everyday problem. Kindergartners tend to do better than 12th graders. I'll bet that most of the teachers reading

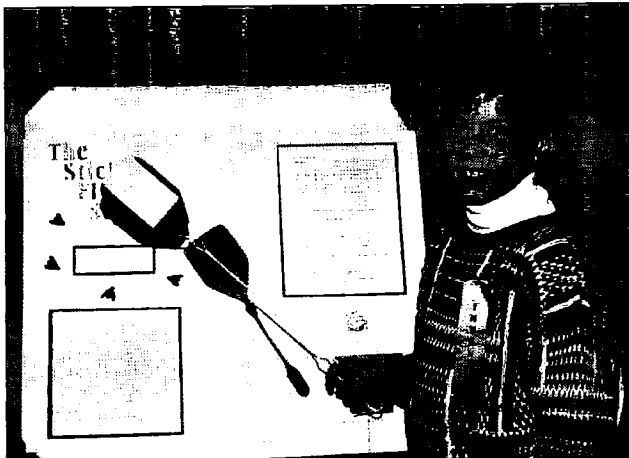


Photo A. Richard Starks, 1990 Grand Prize Winner, shows "The Stick-Um Fly Swatter."

this column recognize why that is so. One of the necessary traits to being truly creative or inventive is to have a mind-set that is basically uninhibited. Younger children seem more apt to have that.

There is a National Creative and Inventive Thinking Skills Conference every year, held in a different city each time. If you would like more information about the conference or about the

Oklahoma Student Inventors Exposition, contact Ms. Betty Wright at (405) 670-3131. She is a Regent for Osca Rose State College in Oklahoma City and has a TV show called "Mail Counts." She teaches gifted and talented children in the Oklahoma City schools. The "Guidelines" brochure for the contest is free to Oklahoma teachers; \$1 postpaid for out-of-state orders. There is a price reduction for 10 or

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Small, crystal-controlled transmitters like the Ryan Communications exciter described the other month are great fun. Crystal control does have one drawback, however: You're stuck on one frequency.

At first I was working on a simple VFO for the Ryan exciter. After a few days on the bench, my simple VFO became rather complex. My Ryan exciter is on 30 meters, so the need for a wide frequency swing seemed like overkill. A better, and perhaps simpler, way to move around the 30 meter band was to swing the crystal's frequency—a VXO. The Ryan exciter's oscillator will not allow VXO operation as is, so I tried several different variable capacitors in series with the crystal, with lackluster results. I then tried building a completely new and different oscillator on a small piece of perfboard. I really did not want to make major changes to the Ryan exciter, so I built a second board containing the VXO.

The oscillator is broadband, thanks to T1. An 2N5179 will develop more than enough umph to drive the Ryan exciter. If you don't have a 2N5179, a metal case 2N2222A will work fine, too. The output of Q1 goes to the broadband transformer T1. The primary of T1 con-

sists of 20 turns of #26 enamel wire on an FTP37P43 core. The center tap is at 13 turns from the collector end of T1. The secondary has four turns of #26 wound over the entire core. Don't bunch this secondary winding all up on one end of the core—spread the turns over the entire core.

The resistors on the output of T1 place a slight load on the oscillator. A 0.01 μ F capacitor couples the output from the oscillator into the Ryan exciter.

You can use any variable capacitor for C1 as long as you don't go over 50 pF. Use a good quality capacitor for C1 as you'll be running it back and forth through its range a great deal. A double-bearing capacitor would be grand, but they are kind of hard to find. Check with KA7QJY Components (P.O. Box 7970, Jackson WY 83001) for his list of variable capacitors.

The crystal used for the VXO should be a fundamental crystal in an HCP25/U holder with a parallel resonance of 20 or 30 pF. Don't get high tolerance crystals—tolerance of 0.01% is fine for the VXO. Crystals mounted in the FT-43 holders do not work well with VXO circuits.

There are two methods of getting the oscillator to talk to the Ryan exciter. Either one will work, and both require some changes or additional circuitry to work.

The best method is to re-work the

crystal oscillator of the Ryan exciter to work with the new oscillator. I tried to couple the new oscillator into the base of the Ryan oscillator. This will work if you're really into milliwatts (I was only able to get about 300 milliwatts from the exciter).

To get full exciter output you'll need to change some components in the Ryan oscillator. The first step is to change the 820k resistor on the base of the oscillator transistor, 2N4124, to 10k. Remove the 270 pF capacitor from the base of this transistor, too. These two changes now make the oscillator on the Ryan exciter into a buffer/amplifier. You can still key the exciter as usual by grounding the emitter of the 2N4124. Connected this way, the output of our VXO, coupled to the base of the 2N4124 on the Ryan exciter, will provide operation exactly like a crystal-controlled exciter.

There is one catch in running the VXO and Ryan exciter this way: You have to keep the external VXO running all the time. You key the Ryan exciter by grounding the emitter lead of the 2N4124. This normally keys the crystal oscillator. Since we've changed the oscillator into an amplifier, the external VXO must run continuously. There are two fixes to this problem. First, just key the Ryan as usual and let the VXO oscillator run all the time and remove power to it during receive. Or, you can short the key line on the Ryan exciter and key the VXO. To key the VXO, you'll need to add a keying transistor in series with the VCC line. A simple 2N3905 will suit the bill here. I went into a bit of overkill and

used a 2N4037 to key the VXO.

Since you may have to add the keying transistor to the VXO oscillator, you can then use a second method of coupling the output of the VXO into the Ryan exciter without swapping out parts. Simply couple the output of our VXO oscillator into the Ryan exciter directly to the driver transistor. Add the VXO drive directly to the base of the 2N5089 driver on the Ryan exciter. When you do this you must key the VXO as the driver will amplify whatever it sees and pass it to the final. You can key the VXO oscillator and you don't have to mess with the Ryan exciter except for one shielded cable from the VXO.

Add an Amplifier

Because you'll not have the benefit of the extra stage of buffering between the VXO oscillator and the driver stage, you may want to add a small buffer amplifier. I have not tried this but it seems like a good idea. The schematic shows such a circuit taken directly from the *QRP Handbook* published by the ARRL.

This is an easy project to build on perfboard—a PC board isn't necessary. Just keep component leads short and direct. Test each circuit before you start on the second one. Be sure you have the Ryan exciter running on a crystal before you start removing parts from its circuit board. Remember, when your soldering iron hits the PC board of the Ryan exciter, the warranty goes up in smoke.

There you have it. VXO operation for the Ryan exciter. This will really bring out the QRP bug now that you are no longer rock-bound.

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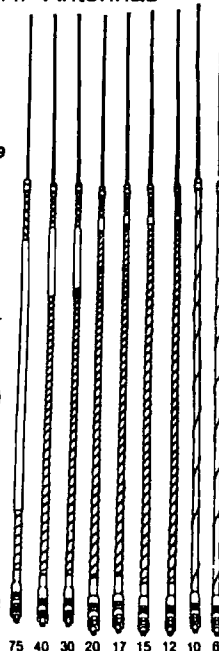
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Getting Started in TCP/IP, Part 2

Last month we started a series of articles on TCP/IP over ham radio, including how to do it. The first installment explained what TCP/IP is, and why it has advantages over the more familiar AX.25 "packet" protocol that most hams use. This month we'll talk about what you need to set up a working TCP/IP station and where to get it.

TCP/IP (Transport Control Protocol/Internet Protocol) is a way of moving various sorts of data in various sorts of packages. Associated with IP are a number of protocols for moving mail, bulletins, and data less—as well as ways of connecting or real-time discussions. We'll explore all of these in this series. First, of course, you need to be able to connect to the world of IP. What do you need to do this?

The "normal" packet radio protocol (AX.25) is usually built right into the hardware that a ham buys for "packet." The TNC (Terminal Node Controller) has a small processor and some firmware in ROM (Read Only Memory) that can talk right to a dumb terminal and radio. All that is needed to connect the pieces together with the appropriate cables and the station on the air.

While TCP/IP uses pretty much the same pieces as an AX.25 station, the bits get switched around a bit. Though the AX.25 station frequently employs a computer as the dumb terminal, it doesn't need to. Anything that can "speak" RS-232 will work. For an IP station, though, the computer takes over most of the "thinking" from a TNC. The IP software puts the VC into KISS (Keep It Simple, stupid.) mode and handles all of the protocol business.

The Computer

Just how much machine do you need to run IP? The answer to this question varies a great deal, depending upon what you intend to do. TCP/IP stations run the gamut from single-user setups that only operate clients—users of other stations—to full-blown multi-service hosts (PBBS). Nearly any computer is capable of operation in the first category. Variations of NOS (the original TCP/IP software from Phil Karn's KA9Q) are available for just about every personal computer, and for UNIX on many platforms. Because of the overwhelming likelihood that you are using an MS-DOS-based computer, that is what we'll concentrate on. However there are also versions for the Amiga (another popular computer among hams)

readily available. In addition, the program we will discuss most—JNOS from WG7J—is available in source code form. If you can use a C compiler, you might just be able to whip up a version for your own machine.

NOS and its variations are designed to be multitasking. That is, they run several processes simultaneously. In practice this means that there are separate, tiny programs doing a variety of things—apparently—at the same time. Since there is only one processor in your machine, what is really going on is a time sharing affair. Process 1 uses the CPU, then process 2, then maybe process 3 or even 1 again. From the user level the events that result from these processes appear to occur at the same time.

All this activity requires as much memory as it can get. Unfortunately, the versions of NOS that you can get today are not capable of using extended or expanded memory. They will use as much of the first 640K as you can give them, though. So, the first requirement for the IP station PC is 640K base memory.

As you might have guessed, multitasking is very CPU-intensive as well. This means that an IP station PC will be happier with a faster CPU. The simple rule is: The faster the better. Slower CPUs will produce various sorts of errors when they are loaded down with IP activity. Remember that the IP station must listen to you and the radio at the same time as it does its housekeeping. The station's use determines this load. A full-service host will run reasonably well on a 286/12 computer, but much better on a 386/25.

The programs and data files needed to run NOS are not that large. You could conceivably run an IP station on a floppy-based machine. On the other hand, even a small hard disk is a big improvement. Also, if you intend to run a full-service host, you will probably want to offer files for FTP (File Transfer Protocol) download. You'll need someplace to keep these.

The TNC

A TNC for IP station use does not need to be anything special. Basic IP operations at 1200 baud on VHF/UHF can be done with any TNC that offers KISS mode operation. The least expensive boxes, like the PK-88 from AEA, do just fine at this. However, if you are in a high activity area, or want to run a full-service host on a "backbone," you'll want to consider fancier options.

Most activity in the digital ham radio world today runs at 1200 baud. This is the normal data rate for AX.25, and is standard on just about every TNC you can buy. Higher data rates are generally more desirable, but 1200 is entrenched. The backbones, though,

usually run at 9600 baud or faster. There is a trend to faster user port speeds with a considerable contingent proposing a just right to 9600 baud. How does this affect your choice of TNC? Just keep this in mind, and think about something that can be upgraded to a higher speed, even if you don't do it now.

The Radio

As far as radio choice is concerned, IP adds nothing to the requirements. A good choice for packet is a good choice for IP. When looking for a radio, keep these requirements in mind:

Choose something modern. While a used radio is just fine, it should be a newer model if possible. Digital radio requires the radio to switch from receive to transmit very frequently. The delay in going between modes is called "switchover" time. This delay needs to be as short as possible to ensure good performance.

Choose something powerful. Though you can use a handheld for packet or IP, it is a risky proposition. For a radio LAN (Local Area Network) to work right, every station (called a node in LAN terminology) must be able to hear every other. With a low-powered station on the net, disruption and unreliable connections are likely. The power requirement varies with the particular LAN. The further the nodes are spread geographically, the more powerful the transmitter needs to be. If you are thinking about using an amplifier on a handheld, consider this: It may not switch fast enough to work at higher speeds. While even COR (Carrier Operated Relay) style amps usually work at 1200 baud, at higher speeds the switchover time of many amps will be too long.

Choose something sensitive. This is just the flip side of the powerful requirement. A sensitive receiver will help to improve the station's performance on the LAN.

Choose a good antenna. With good "ears" your receiver and transmitter will operate more efficiently. You need an omnidirectional antenna, NOT a beam. Remember, all the other stations have to be able to hear you for things to work right. A beam is only appropriate in a limited number of cases. Put the antenna up as high as you can and use good coax—remember that loss goes way up with frequency.

The Software

The rest of the articles in this series will discuss installing, configuring, and maintaining JNOS—a full-service variation on KA9Q NOS. The executable is for MS-DOS-based machines, and is frequently updated by the author, Johann WG7J. I chose to use this implementation for several reasons:

It is popular.

It is widely available.

It has a stable working version with very few bugs.

It has all the features needed for a full-service host.

It will work as an Internet gateway.

It has a reasonably good user interface.

I am using it here.

JNOS offers all of the host and client services currently available for amateur TCP/IP. For the end user, it offers a decent user interface, a split-screen terminal for AX.25 connects, POP mail (more on this later), and up to nine concurrent sessions with hot key switching. For the PBBS operator, JNOS offers superb mail connectivity (normal packet mail plus SMTP and POP servers), excellent security.

My choice of JNOS should not be construed as disparaging to any other NOS implementation. There are lots out there, and all have strengths and weaknesses. Each implementation is slightly different, so I had to choose just one. If you have a machine for which JNOS is unavailable, don't fret. You can get the source and compile a version—or you can find something else that works. While another implementation will not be identical, above the detail level you will still find the information presented here useful.

Getting JNOS

We will be working with JNOS version 1.07b. I will offer two ways to get it but, with a little ingenuity, I am sure you can find it elsewhere. First, if you have anonymous FTP access to the Internet, you will find the MS-DOS executable and source at:

ucsd.edu

In the directory:

\hamradio\packet\tcpip\jnos

The files are:

jnos107b.exe (executable)

jnos107b.zip (source)

jnosdoc.zip (documentation)

Get the executable and documentation files. If you want to compile a special version, get the source. (NOTE: If you don't know what "FTP" is, don't worry—just go on to the next option.)

The second way to get the files is from the 73 BBS. Be warned that the BBS can only do 2400 baud, so this will take awhile. The 73 BBS can be reached at:

603-924-9343 (8N1)

When you connect, follow the instructions and provide the requested information. When you get to the main menu, choose "F" for file area, and "9" for packet. The executable and documentation will be there.

Next Month . . .

. . . we'll actually install the software and start to configure it. While it is not a trivial operation, I imagine many of you will be on the air at that point. In the meantime, you might just try getting on the air without my help. Don't let it frustrate you: The docs can be confusing and the setup is not intuitive. Good luck! 73 de N1EWO

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

The N8EWV R/C Plane

Thanks to the ever-shrinking size of ATV transmitters and TV cameras, a number of enterprising ATVers have been successful in flying their systems onboard modest sized R/C aircraft. This month I'd like to share some of the innovations that Larry Hillier N8EWW of Beloit, Ohio, has designed into his R/C ATV plane.

Starting out with plans for a Hobby Lobby Telemaster (eight-foot wingspan), Larry built his plane from scratch, eventually adding wing tanks (half-gallon fuel capacity) to his current plane to allow for extended flight. The original model was powered with a four-cycle Enya 120 engine, but has been replaced with a 1.6 hp Zenoh 23 two-cycle gas engine (essentially a converted chain saw engine). This new engine allows him to use an inexpensive gas/oil mixture instead of the very expensive glow fuel common to most R/C planes.

The ATV Section

Larry installed most of the ATV equipment in the rear of the plane. His system consisted of a P.C. Electronics TXA5-RC 1 watt transmitter, an FMA5 audio subcarrier board and a Canon UC-1 color camcorder. The camcorder was placed just under the wing in the cockpit, facing out the side window. Larry can control the viewing angle of the camera through the use of a servo which moves the camera from the horizon to about a 45-degree down tilt. Since he uses a Futaba six-channel PCM R/C controller (50 MHz band), he had some extra channels to control the camera angle and to turn the ATV equipment on and off remotely.

Airborne Simplex Repeater

In addition to his ATV station, Larry put an ICOM 2AT and a U.S. Digital simplex repeater controller in the front section of the plane. With 32 seconds of recording capacity (in the high quality audio mode), the plane now acts as an airborne repeater during each flight. Since the simplex repeater is set up on the ATV calling frequency of 144.340 MHz, this works well in alerting area ATVs that the airplane is up and flying.

Larry has had some very long-range contacts using the plane as a repeater. Several stations as far away as West Virginia (over 100 miles away) have worked through the plane during some recent flights. Since there was some confusion as to the operation of a simplex repeater, Larry now operates the repeater with an output on 144.34 but has the input 600 kHz up on 144.94.

The Antenna System

Since he has a variety of transmitters onboard the plane, Larry had a real challenge deciding where to place his antennas to reduce interference to his R/C receiver. He finally mounted an Old Antenna Labs Mini-Wheel antenna (omni-horizontal ATV) under the plane just below the tail. The 2 meter antenna consists of four radials strung along the fuselage and into each wing. The driven element is a 5/8-wave length of piano wire that dangles just below the landing gear. This flexible piece of wire simply scrapes harmlessly along the ground during takeoff and landing, but pops out directly under the plane during flight.

After providing the maximum separation for the antennas, Larry mounted the two transmitters and the R/C receiver as far apart as possible. He also shielded the R/C receiver. The final configuration had the ATV transmitter in the tail of the plane, the R/C receiver in the middle and the 2 meter simplex repeater in the front. He can now fly

the plane so far from him that it is a mere speck in the sky without any loss of control due to interference.

Long Duration Flights

Larry often flies his R/C ATV plan right around sunrise and sunset. He has received numerous reports of excellent video from stations all over northeast Ohio. Many of the reports come in via the onboard simplex repeater. There's nothing like creating your own 500-foot tower to increase your ATV range!

Now that he has a half-gallon fuel tank, he can fly for upwards of 1.7 hours. His most recent duration attempt flew for 1-1/2 hours and he still had 2 ounces of fuel left! At the end of September (the month this column was written), Larry plans to fly his plane over a 60-mile path from near Warren, Ohio all the way up to the shore of Lake Erie. He will follow along underneath the plane while riding in the back of pickup truck with a TV set and R/C transmitter. He plans to keep the plane in sight (both visually and via ATV) throughout the flight. Since the plane is capable of 55 mph airspeed, there should be more than enough fuel for the whole flight.

Larry is planning another R/C AT plane. This one will be a seaplane with the engine mounted above the wing. There will be a movable nosecone that will contain the TV camera and will allow the camera to pan up and down (similar to the Concorde's nose sensor).

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Diagram showing the Ultra Comshack 64 system components: a computer (FM, HMT, CSAS, NMI, PKB, CART), a radio (Simplex or duplex, CS8), and various modules (COMMODORE 64, CS8, New REV B CS8AS board, PATCH, PRINTER, F1757, F1758, F1759, F1760, F1761, F1762, F1763, F1764, F1765, F1766, F1767, F1768, F1769, F1770, F1771, F1772, F1773, F1774, F1775, F1776, F1777, F1778, F1779, F1780, F1781, F1782, F1783, F1784, F1785, F1786, F1787, F1788, F1789, F1790, F1791, F1792, F1793, F1794, F1795, F1796, F1797, F1798, F1799, F1800, F1801, F1802, F1803, F1804, F1805, F1806, F1807, F1808, F1809, F1810, F1811, F1812, F1813, F1814, F1815, F1816, F1817, F1818, F1819, F1820, F1821, F1822, F1823, F1824, F1825, F1826, F1827, F1828, F1829, F1830, F1831, F1832, F1833, F1834, F1835, F1836, F1837, F1838, F1839, F1840, F1841, F1842, F1843, F1844, F1845, F1846, F1847, F1848, F1849, F1850, F1851, F1852, F1853, F1854, F1855, F1856, F1857, F1858, F1859, F1860, F1861, F1862, F1863, F1864, F1865, F1866, F1867, F1868, F1869, F1870, F1871, F1872, F1873, F1874, F1875, F1876, F1877, F1878, F1879, F1880, F1881, F1882, F1883, F1884, F1885, F1886, F1887, F1888, F1889, F1890, F1891, F1892, F1893, F1894, F1895, F1896, F1897, F1898, F1899, F1900, F1901, F1902, F1903, F1904, F1905, F1906, F1907, F1908, F1909, F1910, F1911, F1912, F1913, F1914, F1915, F1916, F1917, F1918, F1919, F1920, F1921, F1922, F1923, F1924, F1925, F1926, F1927, F1928, F1929, F1930, F1931, F1932, F1933, F1934, F1935, F1936, F1937, F1938, F1939, F1940, F1941, F1942, F1943, F1944, F1945, F1946, F1947, F1948, F1949, F1950, F1951, F1952, F1953, F1954, F1955, F1956, F1957, F1958, F1959, F1960, F1961, F1962, F1963, F1964, F1965, F1966, F1967, F1968, F1969, F1970, F1971, F1972, F1973, F1974, F1975, F1976, F1977, F1978, F1979, F1980, F1981, F1982, F1983, F1984, F1985, F1986, F1987, F1988, F1989, F1990, F1991, F1992, F1993, F1994, F1995, F1996, F1997, F1998, F1999, F2000, F2001, F2002, F2003, F2004, F2005, F2006, F2007, F2008, F2009, F2010, F2011, F2012, F2013, F2014, F2015, F2016, F2017, F2018, F2019, F2020, F2021, F2022, F2023, F2024, F2025, F2026, F2027, F2028, F2029, F2030, F2031, F2032, F2033, F2034, F2035, F2036, F2037, F2038, F2039, F2040, F2041, F2042, F2043, F2044, F2045, F2046, F2047, F2048, F2049, F2050, F2051, F2052, F2053, F2054, F2055, F2056, F2057, F2058, F2059, F2060, F2061, F2062, F2063, F2064, F2065, F2066, F2067, F2068, F2069, F2070, F2071, F2072, F2073, F2074, F2075, F2076, F2077, F2078, F2079, F2080, F2081, F2082, F2083, F2084, F2085, F2086, F2087, F2088, F2089, F2090, F2091, F2092, F2093, F2094, F2095, F2096, F2097, F2098, F2099, F2100, F2101, F2102, F2103, F2104, F2105, F2106, F2107, F2108, F2109, F2110, F2111, F2112, F2113, F2114, F2115, F2116, F2117, F2118, F2119, F2120, F2121, F2122, F2123, F2124, F2125, F2126, F2127, F2128, F2129, F2130, F2131, F2132, F2133, F2134, F2135, F2136, F2137, F2138, F2139, F2140, F2141, F2142, F2143, F2144, F2145, F2146, F2147, F2148, F2149, F2150, F2151, F2152, F2153, F2154, F2155, F2156, F2157, F2158, F2159, F2160, F2161, F2162, F2163, F2164, F2165, F2166, F2167, F2168, F2169, F2170, F2171, F2172, F2173, F2174, F2175, F2176, F2177, F2178, F2179, F2180, F2181, F2182, F2183, F2184, F2185, F2186, F2187, F2188, F2189, F2190, F2191, F2192, F2193, F2194, F2195, F2196, F2197, F2198, F2199, F2200, F2201, F2202, F2203, F2204, F2205, F2206, F2207, F2208, F2209, F2210, F2211, F2212, F2213, F2214, F2215, F2216, F2217, F2218, F2219, F2220, F2221, F2222, F2223, F2224, F2225, F2226, F2227, F2228, F2229, F2230, F2231, F2232, F2233, F2234, F2235, F2236, F2237, F2238, F2239, F2240, F2241, F2242, F2243, F2244, F2245, F2246, F2247, F2248, F2249, F2250, F2251, F2252, F2253, F2254, F2255, F2256, F2257, F2258, F2259, F2260, F2261, F2262, F2263, F2264, F2265, F2266, F2267, F2268, F2269, F2270, F2271, F2272, F2273, F2274, F2275, F2276, F2277, F2278, F2279, F2280, F2281, F2282, F2283, F2284, F2285, F2286, F2287, F2288, F2289, F2290, F2291, F2292, F2293, F2294, F2295, F2296, F2297, F2298, F2299, F2300, F2301, F2302, F2303, F2304, F2305, F2306, F2307, F2308, F2309, F2310, F2311, F2312, F2313, F2314, F2315, F2316, F2317, F2318, F2319, F2320, F2321, F2322, F2323, F2324, F2325, F2326, F2327, F2328, F2329, F2330, F2331, F2332, F2333, F2334, F2335, F2336, F2337, F2338, F2339, F2340, F2341, F2342, F2343, F2344, F2345, F2346, F2347, F2348, F2349, F2350, F2351, F2352, F2353, F2354, F2355, F2356, F2357, F2358, F2359, F2360, F2361, F2362, F2363, F2364, F2365, F2366, F2367, F2368, F2369, F2370, F2371, F2372, F2373, F2374, F2375, F2376, F2377, F2378, F2379, F2380, F2381, F2382, F2383, F2384, F2385, F2386, F2387, F2388, F2389, F2390, F2391, F2392, F2393, F2394, F2395, F2396, F2397, F2398, F2399, F24

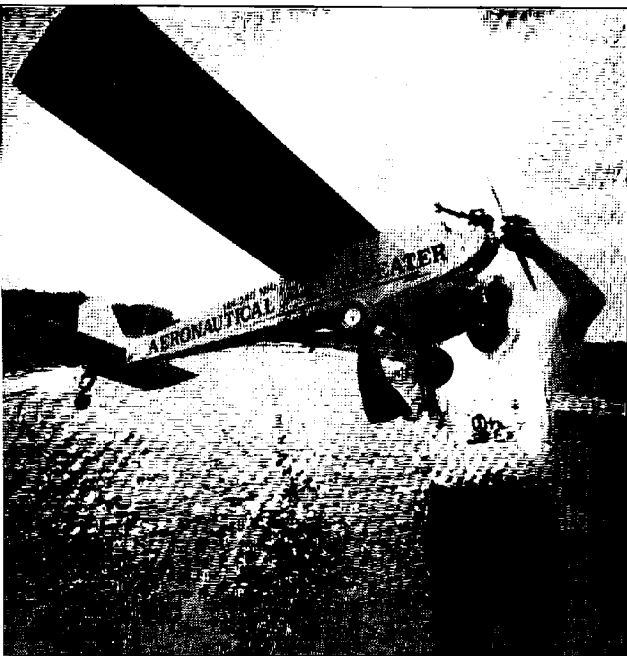


Photo A. Larry Hillier N8EWV with his eight-foot wingspan model airplane. This plane includes a live camera ATV system as well as a simplex 2m FM repeater.

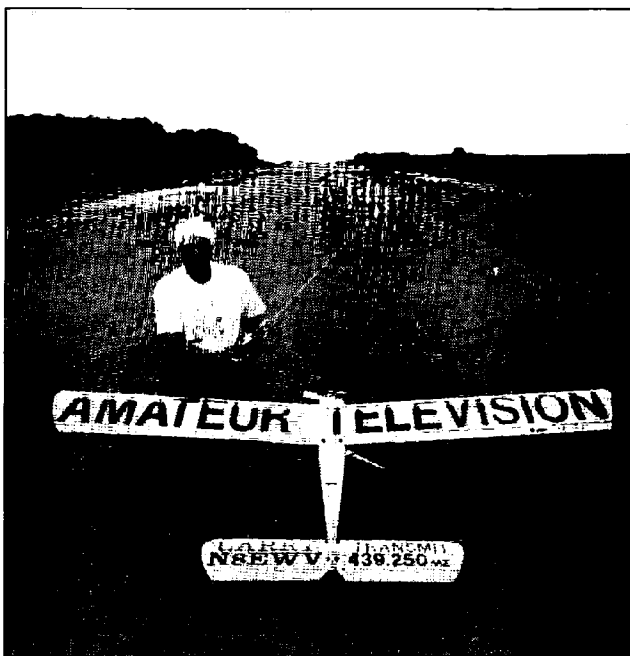


Photo B. Larry Hillier N8EWV prepares to fly his live camera ATV R/C airplane.

ion). The camcorder controls will be remotely controlled via fiber optic lines or a touch-tone decoder, so that all functions including zoom can be operated from the ground.

The KD8PE ATV Repeater

If you are traveling through north-eastern Ohio and would like to talk with Larry N8EWV about his ATV plane, you can usually find him, as well as the

local Youngstown/Salem, Ohio, ATV group, working through the KD8PE ATV repeater during their weekly ATV net every Thursday evening at 9 p.m. local time. The KD8PE ATV repeater is located on a 190-foot tower

in Beloit, Ohio (439.25 MHz input/426.25 MHz out). They use 144.34 MHz for their ATV talk frequency. Also, a number of the ATVers in the area monitor the high profile 146.865 (-600) repeater.

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Microwave Construction Practices

Let's continue where we left off last month when we covered the construction of a basic SSB system. This month I would like to continue with the construction of some basic elements. I will be going into detail on construction techniques for successful projects, describing some useful tools. A lot of questions need to be answered for those just starting a project—but not all can be anticipated. However, with luck, this column should put some of the construction detail questions to rest.

Let's start by discussing some tools and equipment necessary for modifying (or performing brain surgery on) some of our microwave circuitry. Most of these tools must be small or miniature due to the compactness of most microwave circuitry. A basic bench setup consists of diagonal pliers, long-nosed pliers, and various screwdrivers. The soldering iron should actually be a good soldering station. By that I mean a temperature-controlled soldering iron. That's one key pointer for good construction: a low-voltage soldering station.

It pays to search out the nearest "beauty junk box," which is usually found close to the bathroom mirror. What we're searching for are a couple of small pairs of tweezers. I procured mine from the local drugstore in the cosmetics section. The ones from Revlon are the best, but they carry a good price tag. I selected one that had a large, stout hand-hold section and then formed down into a small narrow end section, with a total length of about six inches. They worked out well for selecting components and positioning them on PC boards.

An alternate method is to just dump the component onto the PC board, then try to position it into place with a toothpick, using shuffle-board action. It's not the best but it will work in a pinch. I prefer the tweezers. Part of my trick in using them with very small components lies in the PC board preparation. Here I am talking chip resistors and capacitors and other small surface-mounted parts. Next, I will cover semiconductors and the method used to place them on a PC board.

Positioning Small Components

The real question is: How do you successfully hold a squirming chip resistor or capacitor on a PC board when it's only 0.050" square? Their small size makes them hard to position in place for soldering. Well, that's

partly where the tweezers come into play, but the secret is PC board preparation. If the board is home-brewed like the ones you or I make, they need two preparation steps before soldering. This is not 100% necessary but it can make it easier to place chip components on PC boards. Besides, it doesn't hurt to make the

iron. The board is first lightly coated with liquid rosin. You can use a small paint brush similar to a watercolor brush to apply the rosin to the copper traces. However, I prefer to wet my finger with rosin and apply it with a rubbing action on the copper traces. A liberal amount will work OK, but a little dab will do just fine.

Once the rosin is applied, use a soldering iron with a small amount of solder and gently rub the solder onto the trace. You will notice that using rosin helps the solder to flow, so you don't need to use as much. As you move the soldering iron, add solder

the excess rosin on the board at this time as it is somewhat sticky and will hold a part once it's positioned on the board. If you want, recoat the trace: on top of the solder with a light coat of rosin to help hold chip components. You will probably have to try several of these methods out and find which ones you like best. It's an individual thing.

Chip components are soldered to the trace at one end of the chip. First wet the trace with solder in front of the part. Use a small amount of solder then with a toothpick in the other hand hold the part in place and draw the melted solder pool just in front of one edge of the part up to and over the top of the chip component. Use a sweeping motion over the top of the part. Inspection with a magnifying glass should show a good solder joint looking like a ramp up to the shoulder of the chip component (see Figure 2). If the part moved, re-solder and reposition it before soldering the other end of the component. Once one end of the component looks OK, solder the opposite end of the part to complete installation. Do the same for all components that you need to install, except the diodes and transistors (or FETs). Don't worry about the mess rosin at this time.

When you are ready to mount your diodes and FETs some special precautions are necessary. For most diodes this is not a problem; however, for some signal diodes and expensive Schottky types precautions don't hurt. The diodes and FETs should be handled with proper static precaution taking care not to destroy these parts before installing them in a circuit. There is no need to fret about static-sensitive components as the precautions for using them are not too demanding. Mounting them with grounded work station will remove the static voltage.

Removing the Rosin

When the other components are mounted it's time to remove the rosin which looks quite sloppy on the board. Removing rosin is important because it can have a detrimental effect on the board. It can de-tune the microwave stripline and cause excess loss. It can

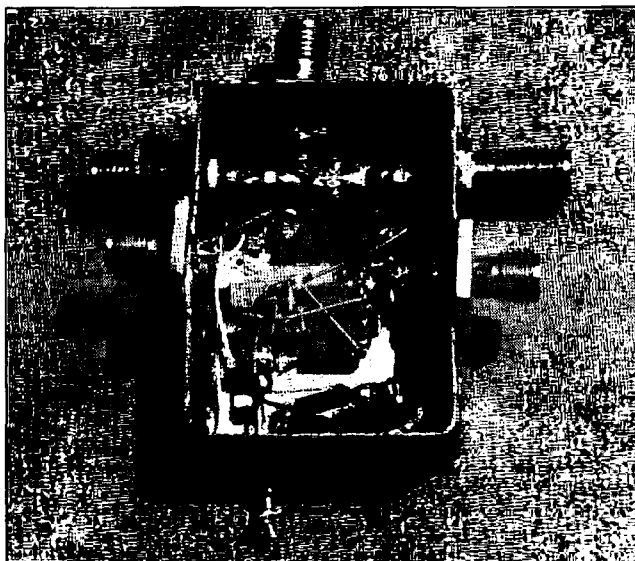


Photo A. This unit has been modified countless times and the FET is still performing well. The circuit is a 10 GHz amp, modified into a 10 GHz mixer. The circuitry at the bottom is a bias supply.

project look a little nicer. The first step in board preparation is to apply a thin solder coat on the stripline traces to help in the component soldering operation. This step is performed before any components are mounted on the PC board. A solder-coated PC board is easy to solder and this step also helps to prevent oxidation of the copper surface.

The solder coat operation can be performed with any small soldering

only when necessary to fully coat the trace. In this way the PC board will become fully coated with a very thin layer of solder on the traces and ground surfaces. This will give your PC board resistance to oxidation and help in the soldering of chip components.

I can't stress this enough: Use solder sparingly. A very small amount can be spread across the trace with the aid of some excess rosin. Leave

PC Board
Stripline Side

Dots = Gold Metalization Over
Ceramic Case Of FET

PC Board

PC Board

Ground Side Of PC Board

Figure 1. Insert the FET and solder the gold metalization to the bottom of the PC board and to the top source traces. You want to take the shortest possible path to ground to find the lowest possible source lead impedance.

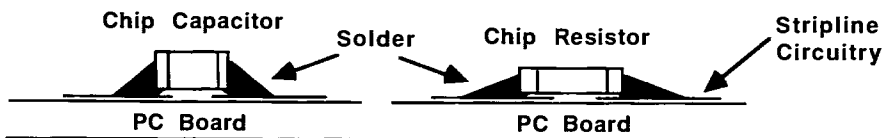


Figure 2. Component mounting detail.

Source Lead Stripline Connected To Ground



Figure 3. Using "C straps" made from thin copper foil.

also attract the most undesirable material and stick to it, further de-tuning your circuit.

The best method to remove this grungy (rosin) is to use a small plumber's acid brush dipped in alcohol. These brushes are available in most hardware stores for about 20 cents each. Wash the PC board with it. Dip the brush in rubbing alcohol and apply it to the PC board on a slight slope to allow the liquid to run off the bottom of the board. Continue to apply with a rubbing motion with the brush, dipped in alcohol frequently, until all the rosin is removed.

For small PC boards, hold the

board above a glass ashtray, using it for a container for the alcohol. Use a small amount of alcohol; a capful or two is sufficient. Alcohol is flammable so keep it away from heat sources. You might need a second rinse to give the board a very clean appearance. Once the board is clean, air dry it or wipe it dry with a rag before mounting the semiconductors and FETs. Always use the grounded static-free work station for this operation.

Other Tools

Now, here are some of other tools to get, besides the tweezers: magnifying glass or eyepiece, some tooth-

picks, liquid rosin, plumbers' small acid brushes, small diagonal cutters, plus long-nosed or needle-nosed pliers and a good temperature-controlled soldering station. Add to these items a good selection of X-acto handles and blades that will be used in the tuning and cutting of PC board traces to make modifications to the stripline circuitry. These modifications are very necessary to microwave circuitry, and are done with X-acto knives. In this phase of modification you will be cutting traces and trimming them with the knife blades. In microwave work these are our variable inductors and capacitors that are

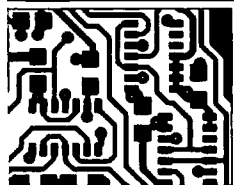
formed by traces on the PC board. When you make cuts, hold the knife firmly and do not push hard on the Teflon PC board—Teflon microwave substrate is very soft and light pressure is all that is necessary. Be sure the DC power is off when doing any trimming on PC boards.

Toothpicks are used to make tuning tools. Glue small bits of copper on the ends of several toothpicks and when they're dry they can be moved about active amplifiers to give you an idea of where to solder permanent copper straps to the stripline. These toothpick tools are quite simple—just don't touch two adjacent leads together because a short is a short is a short, and will most likely smoke a component.

The Static-Free Work Station

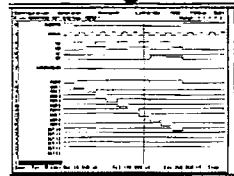
At this point, let's describe the static-free work station where we will assemble and mount the static-sensitive components. This can sound quite impressive, but actually it is very simple and easy to construct. The main difference is that all construction is done on a sheet of scrap metal or circuit PC board used for a common ground surface, to which all components and tools are grounded. This removes any static buildup from your work area. No dragging your feet on a carpet before going to work at the station! Sparks are not permitted. If you

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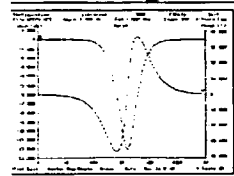
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fear the worst, do your construction on a moist day, a minimum static day. Still use the grounded work location.

Your work station pad (a sheet of copper or conductive metal) is where we place the circuit to be worked on (the PC board). Adjacent to the area reside the temperature-controlled soldering iron, tools, and you! Be sure to use a resistive conductive wrist strap and not a direct connection to your wrist. Usually these wrist straps have a built-in resistor in the clip lead portion with a resistance of a half megohm or so for a safety factor. The high resistance is so that current that can be dangerous to you will not flow. It will remove static and bleed it off to ground; discharge it. The purpose is to remove static and not carry enough current to light you up.

Don't fall into the trap of "cheating" by touching and holding the grounded work station with your finger while trying to perform the operation. This is not recommended—it is asking for trouble. Use the wrist strap and its protective series resistance. It is there for your protection.

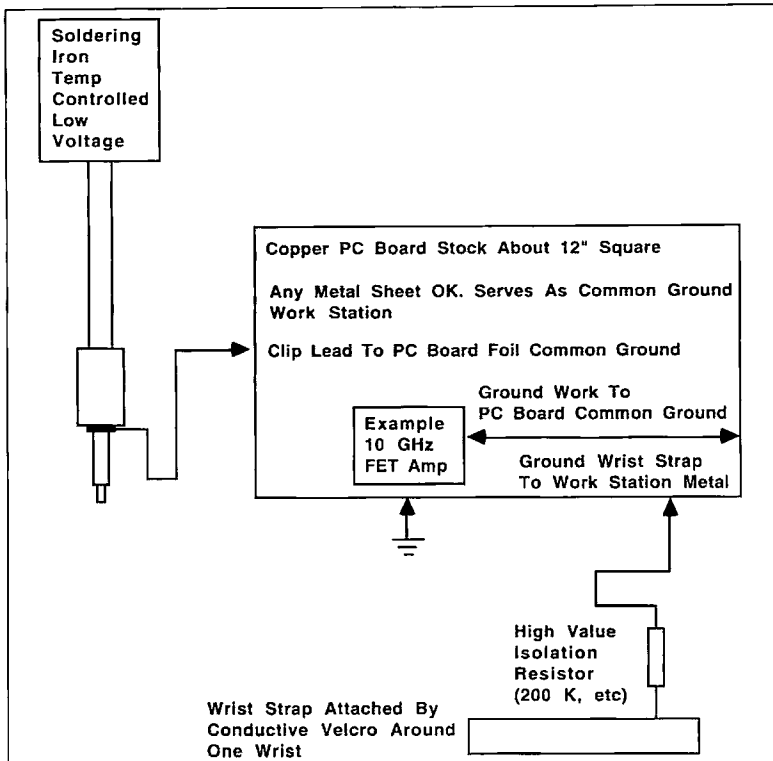


Figure 4. Construction of grounded work station. Notice that the soldering iron, work piece, and your wrist are all common grounded to prevent static from destroying sensitive FETs.

Soldering Iron Grounds

The only major tool purchase should be a temperature-controlled soldering station. Most used ones or even many new ones do not have a ground connection brought out to a clip lead. They are grounded in some cases; always check. If you do not have a ground clip lead it can be added to the low voltage portion of the iron. These irons are operated from 110 AC and converted to a low voltage in the base unit. Usually it converts to around 24 volts to heat the iron element. To add a ground connection to this type of iron, make a connection from the barrel of the iron at a low temperature point, or better still through the iron's ground lead to the transformer's base. In this case, a connection can be made in the transformer base unit and brought out for connection to the work station.

This clip lead connection is used to remove static from the metal portion of the low voltage iron so as not to harm the semiconductor when you solder it. If you have a high-voltage iron, one that works and heats from

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PD-440N		420-450 Mhz		NO	Linear	1/2 OR 4-5W = 18W	T/R 119
PD-440N		420-450 Mhz		YES	Linear	1/2 OR 4-5W = 18W	T/R 143
PD-440N-1				NO		1/2 OR 4-5W = 35W	T/R 155
PD-440N-1				YES		1/2 OR 4-5W = 35W	T/R 179
PD-440N-2				NO		1/2 OR 4-5W = 60W	T/R 205
PD-440N-2R				NO		3-4W = 60W	199
PD-440N-3				NO		3-4W = 60W	T/R 235
PD-440NM				NO		1/2W = 8W	75
PD-440NM				NO		1/2W = 8W	T/R 118
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110 VAC directly, this can be made to work as well. What you have to do is *unplug* the iron just before each soldering operation (with the same type ground clip). Prior to attaching a ground clip on this type of iron verify its AC leakage voltage, a safety factor.

We are doing this to see if the tip is insulated from the heating unit, which is a 110 VAC element. Sometimes the insulation breaks down and allows AC to flow through this defect. It's a safety item and should be checked every so often. Be careful and use insulated test leads for the AC voltage check. I have checked similar irons and good ones will show very low voltage readings, less than a volt or so. However, I have found some that were almost direct connections to 110 VAC due to cracked insulation in older irons. Check to be sure for safety and semiconductor survival.

Mounting Semiconductors

Mounting the semiconductors is very easy. I mount the diodes first. On every small glass-leaded diodes be careful not to bend the leads too close to the package for soldering as the glass can crack on this type of diode during mounting. Just bend the leads to the position you want them and allow a little slack in the leads about 1/8 inch. Use the tweezers to serve as a heat sink and grounded installa-

tion tool when soldering. Prior to mounting FETs, all PC board preparation such as cutting mounting holes or source ground "C" straps should be complete.

Follow the FET mounting instructions. If they state to mount the FET upside-down you need to cut (with the X-acto knife) a 0.1"-square hole to position the FET into. In this case, the

source inductance are requirements, particularly at 10 GHz. In 10 GHz amplifiers that we have constructed, the minimum inductance or shortest lead length was found to be the best solution to achieving maximum gain and uniform operation at 10 GHz. Both using the "C" straps and mounting over metal devices upside-down can achieve the same results: stage gain

the FET or the FET and "C" straps. "C" straps are made from thin copper flashing material and are about 0.050" wide. As shown in Figure 3, they are soldered onto both sides of the PC board. One side is the rear ground foil and the other side is the stripline side source trace for grounding. These straps resemble a "C" when they are formed through a PC board hole.

The last thing to remember is mounting the FETs. They are stored in a static-sensitive protection package and should be picked up only with grounded tweezers. Touch the envelope or box conductive portion (FET storage shipment container) with the grounded tweezers first before touching the FET. This will discharge any differences between the ground surfaces of the work station and the package or envelope. Then, and only then, pick up the FET and place it directly where the device is to be soldered onto the PC board. Once soldered on the PC board the FET is protected by circuit terminations on the board.

Well, that's it for this month. Hope you enjoyed this month's shop talk. As you can see, an elaborate workbench is not required. Happy construction! As always I will be glad to answer questions concerning this and other topics. Please send an SASE for a prompt reply. 73 Chuck WB6IGP.

73

"Check the details on construction for the project you plan to duplicate. Use their recommendations."

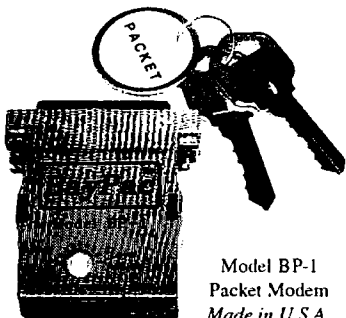
ground side of the PC board is soldered to the gold of the FET for minimum source inductance (see Figure 1). If the FET is mounted right-side-up, most likely "C" straps are being used and the circuit allowances were made for some slight inductance. In some cases I have even seen right-mounted FETs; that is, the opposite lead has been trimmed off and the remaining source lead is connected to ground with an additional short section of solid wire. This is a stabilizing technique (degeneration) and is used at frequencies lower than 3 GHz.

The "C" straps and minimum

and minimum inductance. Check the details on construction for the project you plan to duplicate. Use their recommendations.

In case of trouble, it helps to have the side of the hole beefed up with a small scrap of copper foil to aid in soldering to the top of the upside-down FET. The thing to be careful about is that the "C" straps do not short out the GATE or DRAIN leads to ground. If this dimension looks close, trim with an X-acto knife for some clearance between leads before mounting the FET. In either case, the hole cut into the PC board will accommodate either

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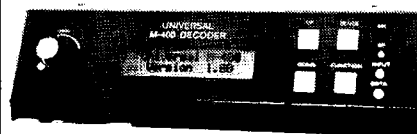
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Let's Mobile

Last month, we were talking about mobile operation. Before we continue, I'd like to pass along a fix for a problem I ran into.

A Detective Story

At a recent hamfest, I picked up a used Kenwood MC-85 desk microphone. It's a nifty microphone which has a condenser mike, built-in compressor and outputs for three separate rigs. I mentioned my purchase to a good friend who used to own one, and he warned me that the mike was very sensitive to RF feedback and, thus, poor for HF. I figured his must have had some kind of problem and proceeded to wire the cable up for my Yaesu FT-747GX.

I keyed up and it worked great! I got several good reports and apparently had no RF feedback problems. I was happy. The next night, I had a sked with my friend, and he reported that I sounded *terrible*, with lots of RF feedback. A quick listen on another receiver confirmed his report: The thing was a disaster. What had happened in the preceding 24 hours?

Ah, Sweet Ground

Usually, when you have an RF feedback problem you have a lousy ground connection somewhere. Finding it isn't always easy, though. In fact, I've had some tough times with these kinds of problems. But not this time. The thing gave itself away when I noticed that grabbing the mike's metal gooseneck, which also encloses the mike element itself, caused extra RF feedback pops and noises. Yet, touching the rest of the metal housing did not have any effect. Now I knew: The gooseneck was not properly grounded to the housing. Upon opening the unit, I discovered that it is built in two pieces. The PC board is mounted and grounded to a metal frame which then screws to the housing. The gooseneck is screwed directly to the housing. So, if the screws holding the frame to the housing are even a little bit loose, the ground between the gooseneck and the PC board gets funny. The cure was easy: I added a ground wire directly from the gooseneck's nut to the PC board's frame. Voilà, no more RF feedback! If you have an MC-85, you might want to add this wire, especially if you have had any feedback problems.

Back To The Car

Out of the shack and back into the car. OK, you've installed your HF rig; you've run your fused, heavy-duty

power cable from the battery to the radio; and you've installed and wired your antenna. You turn it on and, hey, it works! Sounds nice and clear, too. But wait, you haven't turned the engine on. Uh oh, now it sounds like garbage. Noise and static out the wazoo. Unfortunately, when you are running a multi-kilovolt ignition system a few feet from a device designed to detect a fraction of a microvolt of RF, you're gonna have some problems. Is it possible to get decent reception in the car?

You Betcha

It'll never be as noise-free as a good, quiet home station, but you can get good results in the car. As an example, my Mazda RX-7 used to have an S-7 to S-9 static level, even with the rig's noise blanker on. (It should always be on.) I just assumed that was the best I could do and was resigned to living with it. Consequently, I rarely operated HF in the car. A few months ago, the car started running poorly, so I decided to give it a tuneup. I changed the plugs, wires, rotor and distributor cap. Hey, my noise level went down to S-3! And my car ran great, too. Ignition problems, and especially bad plug wires, can really drive the noise level up.

Other Sources

There are lots of other noise sources in an automobile. Any poorly joined body parts can make electrical noise as they rub with the car's motion. Even wheel bearings can make noise! There are too many potential problems and solutions to cover here, so, if you have a really stubborn static problem, get a book devoted to mobile radio installation.

There are two big noise sources which keep cropping up: fuel injectors and the car's computer. Some makes and models have particular problems which are known to the manufacturers, and a call to the dealer may bring forth an internal memo on the subject. Then again, it may not. Some injectors and computers are just noisy and there's nothing you can do about it. Sometimes, though, the manufacturers have replacement parts or modifications which greatly reduce the noise. Some will even do it for free.

Warning!

As you can see, it is very common for your radio to be QRM'd by your car. But there's something worse: You can QRM your car! Today's cars are electronically sophisticated; virtually all use computers to control the engine. Some also use them to generate the dashboard displays, control the cabin environment and various other things. Some of these computers are quite sensitive to RF, and a few can actually be destroyed by your transmitter, even

if it is only a 25 watt VHF rig! If your car misfires or otherwise misbehaves when you key up, you are probably trashing the computer, so you should investigate the problem before you cause some expensive damage.

Honest, Officer, I Didn't Mean It

I remember using my 100 watt HF rig in my old car, which was a 1984 Oldsmobile Cutlass. Once, while tooling around in the Vermont mountains, I was yakking away while rolling along under cruise control. Normally, I watch the speedometer carefully, even when I use the "autopilot." This time, though, I got distracted and never looked down. Suddenly, it seemed like I was going awfully fast. Sure enough, I was doing 85 and still accelerating at the maximum rate. Yikes! I reset the cruise control and everything was fine. And I never got it to do that again. But I have no doubt that my transmitter caused it. Thank goodness I didn't get caught; I would have never explained that one.

There have been many reports circulating on packet radio regarding Toyota Camry computers being destroyed by RF. In fact, several hams wound up with repair bills over \$1,000, because the damage wasn't covered under warranty. Apparently, there was an internal memo stating that radios over 10 watts output shouldn't be installed in those vehicles. Last I heard, though, the problem had been fixed. This is only a rumor, however. If you are contemplating getting one of these cars, you might want to check with your dealer before you buy. If you already have one, it would pay to find out if you're courting disaster every time you check into the local repeater.

The Skyhook

Mobile antennas present extra challenges at HF, mostly because of their small size relative to frequency. The standard mid-position loading coil arrangement works fairly well above the 40 meter band, but I haven't had much luck with it on 40 and 75; the efficiency is just too low. But there are other designs which work reasonably well, although nothing is going to work as well as a dipole 50 feet up! The oddest automotive HF antenna I ever saw belonged to a guy I met at a New England hamfest. It's kind of hard to describe this thing: The best I can say is it was horizontal, took up the entire length of his large, American car, and made his vehicle look like something from another planet. He designed it himself, and he claimed it worked like gangbusters on 75 meters.

Although there are several antenna tuners made for HF mobiling, I think it pays to get your antenna as resonant as you can. Efficiency is not that high to begin with, so you're better off if you don't have to use a tuner.

Sometimes, it seems like you have better bandwidth and lower SWR than you expect to get. Before you go rejoicing, take a look at your ground connection between the antenna mount and the car. Usually, a too-good

SWR over too wide a bandwidth means you have exceptionally poor efficiency and are losing a lot to resistive loss. Remember, a dummy load a ways has the best SWR.

Louder?

Can you install a linear amp in your car? You sure can! There are seven which have been made over the years and at least one is still available. Needless to say, you're gonna need some serious amperage to run something like that. A big battery and a giant alternator will need to be routed through humongous cables to the amp. And don't forget that all that RF power will be 2 or 3 feet from your head. Personally, I think I'll pass.

Pounding Brass

Can you pound brass in your car? Sure! I've tried it a few times, using the Microkeyer iambic keyer project I published some time ago. It works and it's fun, but you need to be a decent C'op to avoid getting so distracted that you impair your driving. Obviously, you can't be writing anything down while you drive, so you need to copy in your head. RF feedback into the keyer's hand key can be a problem which results in RF burns on your fingers. Be sure to use shielded cable from the key or keyer to the rig.

Well, that about covers it for mobile operation. There's a special thrill you get from talking around the world, around town, while you cover the distance between home and work, wherever. Happy and safe mobiling! Now, let's look at a letter:

Dear Kaboom,

I'm considering upgrading my station and I'm very interested in DS (digital signal processing). Several rigs offer inboard IF-level DSP units and there also are several third-party outboard AF-level DSP units available. Which is better?

Signe
Dr. Di

Dear Dr.,

In theory, IF-level signal processing should always be better than AF-level processing, because you deal with a signal before the AGC stages. That way, if you remove an offending signal it won't cause unwanted AGC action. With AF-level processing, you have control over that, and strong interfering signals near the one you want to copy can still cause trouble, even though I filter has taken them out, because it causes the AGC to clamp down.

As practiced today, though, it's a different story. The functions available in the inboard units just don't compare the neat stuff you can buy in the outboard, AF-level boxes. So, for now, I recommend you go with the outboard approach. Perhaps in a few years rig makers will put some serious effort into DSP and catch up with the specialty makers. By the way, I cover this subject in some detail in the July and August 1993 issues of *Radio F*. You might want to check those out. Enjoy your new gear! 73 and see you all next month, de KB1UM.

HAM HELP

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mamin Tan, United Marketing, Isabela, Basilan Province, 7300 Philippines.

I am looking for mods for the HTX-202 2m HT. If anyone has any, please send to Trevor Davis VE3DKV, 107 Government Road East, Kirkland Lake, Ontario, Canada P2N 1A9.

I am looking for the schematics, manual, or info on the Hammarlund FM50a or its power supply. I will gladly pay for copies and shipping. I am trying to use this unit for Civil Air Patrol communications. Any information will be helpful. Thank you. KB2QGO, (716) 526-5336.

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I need operation and service manuals for COLLINS Model 32MS-1C tube-type transceiver, Serial #287. I will pay copying and mailing expenses; or furnish me the latest mailing address of Collins Radio, Canada or USA. Thanks to all who respond. Ben-

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CIRCLE 188 ON READER SERVICE CARD

NEVER SAY DIE

Continued from page 4

The main problem is that we're not interesting our newcomers enough to hold them. They go to a club meeting or two, find they are treated like lepers, and give up. Ten meters is nearly dead and will be for a few years. And CW at 5 wpm isn't nearly as much fun as you've told them it is. The result is that 94% of the Novices aren't seriously active. They spend less than an hour a week. That rattle you hear is amateur radio's death rattle unless you can figure some way to make hamming more fun. Fast. We're dying.

Oh well, Novices are kids anyway, right? Well, not exactly. Their average age is 39. Heck, when I got started in amateur radio the average age for all hams was about 32. Now the Techs average 45 and it's 50 for all hams, which puts the Advanced and Extras up in the 60s. No wonder almost everyone I work on 20m is retired.

Has your club made any effort to get newcomers to your meetings and get them involved with club activities? The answer, with very few exceptions, is no. Two-thirds of the Novices have never been to a club meeting. Most of the rest tried one or two and gave up in disgust. Very few said they were involved with any club activities.

What ever happened to the old ham radio fraternity concept? I read many of the club newsletters and I see

very little evidence of efforts to involve newcomers. We've let the hobby turn sour on our watch. We're putting up with bad language on our bands. Our personal ethics are a mess. We've cut off our newcomers. We used to be very proud of being hams. And rightly. We were the pioneers of all new radio modes. We were the major supplier of the best engineers and technicians to industry. And when WWII came along we helped save the country's bacon by volunteering for military duty. Eighty percent of us joined the armed forces. And don't you forget that it was electronics that was our big edge. It was a technology war and we hams were right there in the thick of it.

We've let ourselves become virtually useless. In 1964 we killed off thousands of school radio clubs. These were the clubs that led us young newcomers and we've never had any significant growth since. Nor, lacking the enthusiasm and drive of youngsters, have we been able to keep up with commercial technology, much less be in the forefront.

If you were running a business and you found that you were getting fewer and fewer customers, would you consider making some changes? Worse, most of the new customers you get to come in the door go right back out and don't come back. Are you doing something wrong? Has your product or service kept up with the world as it is today?

In business you either grow or die. So what's holding back our growth? I've been talking about that in my editorials, so my ideas on the subject won't be any news flash for you. But let's not just accept my ideas. And let's not stick by the ARRL's either. Let's survey the kids and find out why they're not interested in amateur radio any more. Yes, I know all the old excuses. TV, video games, on-line computer services and such keep kids too busy for them to take the time to learn the code and memorize the pathetically simple tests we've got set up as obstacles to keep out the "wrong" people.

Well, I've seen no sign that we've had any success in barring the wrong people. We've done a really fabulous job of keeping a lot of "right" people out.

The League hasn't a clue as to what to do to turn things around. They're asking, "What, if anything, can be done to reverse the trend?" Am I exaggerating? Check out page 9, July 1993, QST, last paragraph.

Wayne's Prescription

I'd like to see amateur radio fulfill its real potential . . . to help kids, our country and the world. I'd like to see millions of kids getting on the air and filling up our incredibly valuable, but presently vacant, microwave and satellite bands. I'd like to see 'em experimenting, building kits, and pio-

neering new technologies. We have no shortage of new modes for them to develop.

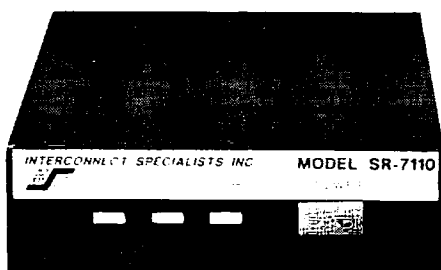
One thing we do know from experience is that everything our government does it messes up, and the management of amateur radio is no exception. I wish the socialists and liberals left would go live awhile in the remaining socialist countries, China and Cuba, and get over their delusions. Maybe they'd stop trying to get the government to do everything for us.

My dream is to have amateur radio run by our radio clubs instead of the government. The clubs would be responsible for recruiting newcomers . . . kids in particular. They'd Elmer radio clubs in schools. The clubs would teach theory and operating practice; and then would license the member who earns the privilege. The club would be responsible for their licensees and for the de-licensing of any member abusing our privileges.

I envision a national conference every other year where delegates from each of the clubs would discuss any vote on any rule changes proposed by the clubs. I'm sure you can come up with a long list of reasons why this wouldn't work. But I warn you, though I haven't taken 10 pages here to try and refute your objections, I doubt the you'll be able to come up with one for which I haven't a good answer. I've given this a lot of thought.

Indeed, a few years ago I made the

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CIRCLE 331 ON READER SERVICE CARD

rounds of the FCC Commissioners and asked them how they liked the idea. The all agreed it would be a great system. They also agreed that the FCC would be glad to provide whatever legal expertise might be needed in the framing of new rules. The FCC would love to get out from under the expense and aggravation of handling our rule making and licensing. The Commissioners know little about amateur radio and, for the most part, would prefer to keep it that way. Well, if the White House ever gets around to appointing some new Commissioners we'll have a fresh opportunity to rewrite our ticket.

I've pointed out in my recent editorials that unless we do come up with some major changes in our hobby, we're sitting ducks for any well-funded obnoxious effort to knock off. Our bands are essentially up for grabs unless we re-invent a relevant need for them. I recommend this be centered around our 21st century need for one hell of a sharp bunch of engineers, technicians and scientists. Without 'em our American standard of living is going to keep in dropping, and so will the dollar.

Technology developments in communications, computers and transportation have narrowed the oceans which isolated us from Europe and Asia. We're now in competition with the whole world and we'd better understand this and stop trying to erect trade barriers to protect our under-

skilled, undereducated workers.

The most successful countries are going to be those making high-tech products. The big money is in manufacturing, not flipping hamburgers or sorting mail by hand. So we've got to re-invent our whole lousy school system so we can create a flood of youngsters who are excited about technology and looking for high-tech careers. Super Mario Brothers isn't going to do it. Even CompuServe isn't going to do it. The only hobby we have with the potential to fire the enthusiasm of millions of kids to learn about electronics is amateur radio.

We can get 'em on the air. We can set up our ham satellites so they can talk anywhere in the world 24 hours a day. We can get 'em excited about fox hunting, QRP, packet, SSTV, and so on. Maybe we can get back to where we were in the 1950s when 80% of all newcomers to amateur radio were youngsters, and where 80% of them went on to high-tech careers as a result. If America doesn't manufacture the electronic equipment for our businesses and homes, you can be sure someone else will, and where these factories go, so will the biggest banks, and the highest quality of life.

Can the FBI Help?

Voice-operated transmit (VOX) seemed like a great idea when it was invented, but it never got off the ground. You know why? Several rea-

sons. The clanking of the antenna relay was one big problem. The slow recovery time of most receivers was another. But the worst was that if there was any interference the other station was never sure just when you were listening. So what happened when ops used their VOX was they'd keep right on talking to keep that relay from clacking. In between sentences they'd "aaaaah" it to hold the rig on the air.

Modern technology has done away with most of the relay noise and has improved our receiver's ability to be turned on and off quickly. That leaves us with only one minor problem: letting the other person know when we've stopped transmitting.

The best way to generate normal conversations instead of our one-way broadcasts to each other is to separate our transmitters and receivers by a few miles so we can listen while we're talking . . . as I suggested recently. But if this is beyond your ability to handle, the next best approach is fast break-in (FBI). Now, in order to let the other person know when you've stopped transmitting I suggest you add a little beep, like the ones we use on our repeaters.

Let's see what you can do about building a circuit which will automatically beep or chirp when you stand by. If this catches on we'll soon see it being built into the new rigs. In the meanwhile, look for some kits. Yes, I know, there are a few DX chaps al-

ready using this approach. Good. What I want is to help make it so we can have the most natural conversations possible. This will make hamming more fun and help attract more newcomers to the hobby. I've gotten several letters recently from non-hams saying they lost interest in getting a license after hearing how boring so many of our contacts are. I know I'd be a lot more active if more contacts were interesting.

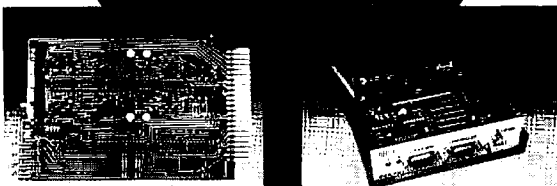
Get busy and design a circuit, check it out, and send me an article so we can get a few hundred hams to build it.

Once we're using fast break-in we'll have to break the ID habit. Every 10 minutes is fine. And it isn't necessary to repeat my call all the time. I already know it just fine.

I'm hoping that between duplex and fast break-in we'll be able to start talking more naturally and as a result our contacts will start being more interesting. I'd still like to see some way to have you send a list of things you're interested in so I'd know what to ask you. I'll bet you've done some fascinating things I'd like to hear about. Maybe you've been some places I'd like to visit. Maybe we have some other hobbies in common. We could have a great time and really be looking for each other for more contacts.

But a stereotyped QSO bores me silly. I guess it wasn't so bad for the first 25 years or so, but it's gotten old.

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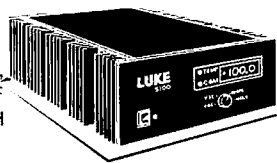
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CIRCLE 243 ON READER SERVICE CARD

A Quote from Forbes

A recent *Forbes* column by Peter Huber discussed the effect technology is having on us. For instance, when I was young we spent a lot of time on penmanship. Well, handwriting was how one communicated then. Typewriters were too expensive for the home and typing wasn't taught in school. Once typewriters were cheaper, the need for good penmanship disappeared.

Spelling was a big deal when I went to school. Now it's handled by my word processor, which catches my errors. Peter suggested that before long making kids memorize all the irregular spelling rules will be like making radio engineers learn the Morse code. Heh.

We'll soon have automatic language translation, and computers with voice input. Look where we are with bar-code and checkout counters which add up the items, calculate the change, debit the store inventory, and presumably even add in a few cents here and there to pad your bill. Fast-food cash registers have pictures instead of numbers, which is handy since fewer and fewer kids are being taught how to make change.

If you're into video you can have a complete video production lab at home and do what used to take millions of dollars in equipment all by yourself. In audio, DAT recorders are

under \$1,000 and outperform a whole studio full of gear from a few years ago. Gas stations let you pump your own and pay with a credit card, with no attendant needed. Well, we're a little behind on that one. I remember HB9RF doing that in Zurich over 20 years ago as we were driving to visit his moonbounce station.

"Are you keeping up with technology? As a ham you're expected by the public to be knowledgeable about high-tech."

Are you still writing by hand? You're two generations behind. I changed to typewriters as soon as I could, carrying portables with me on my trips. Then I changed to word processors, moving to a laptop system around 1980, as soon as the first one was available. I moved from CW to voice in 1939 . . . and from voice to RTTY in 1949. I put up my first repeater in 1969. Our pioneering HTs and repeaters of 1970 are now worldwide as cellular telephone systems.

And look what's happened to those microcomputer kits we were playing with in 1975! Now we're using them to replace million-dollar typesetting systems. One of the first ads for the MITS Altair 8800 computer appeared in 73.

Are you keeping up with technology?

As a ham you're expected by the public to be knowledgeable about high-tech. Can you see where technology is taking us? All you have to do to get ahead of the game is know something like that before others do. Joe Sugarman W9IQO figured out that there would be a market for electronic gadgets, so he started selling them by

mail as JS&A and made millions. Steve Jobs figured there was a market for a single-board microcomputer, and didn't do badly. Bill Gates figured these new micros would need operating systems and parlayed that idea into a few bil.

If you really want to feel bad you can dig out some old issues of 73 and read where I told anyone paying attention about these opportunities at the time, including the one Bill Gates exploited. There are just as many opportunities today, if you think in those terms. Steve Jobs started out with nothing but a prototype built by Steve Wozniak. Bill dropped out of Harvard to work for MITS, in Albuquerque, where the action was.

Communications, computers, information systems . . . all are changing.

We're ready for a major change in education which will generate a few more billionaires. Ditto health care, which is a trillion dollar industry, and growing fast. How close are you to the change? Close enough to see the opportunities and benefit?

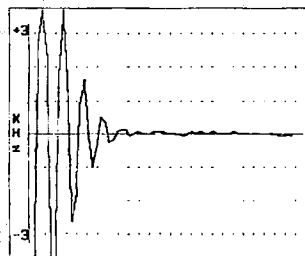
Every major misery we have in America offers opportunities for the person willing to pioneer and work. The downside is that if you're money driven, your chances of making it big are not good. You'll do best if you see something that needs to be done, figure out how to do it, and then work hard. Bill Gates made his billions accidentally. He's still wrapped up in what he's doing, not in making money.

In my reports to the New Hampshire Economic Development Commission I've been coming up with endless ideas for new businesses and new areas that need to be researched and pioneered. My first reports have been reprinted in my *Declare War* book. Those since then are in my *Declare War Update* reports. They're available via Uncle Wayne's Book shelf.

One of my joys is in getting letter from hams thanking me for keeping a them through my editorials to get out there and be an entrepreneur. Some have been very successful, and a of them know a freedom they neve experienced before.

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CIRCLE 248 ON READER SERVICE CARD

Amie Johnson N1BAC
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Notes from FN42

As this month's column is being written, we in the U.S.A. are watching Hurricane Emily churn toward the central East Coast, hoping the storm will not strengthen and cause damage to life and property. So far, we have been very lucky in that no loss of life has been suffered, even though the storm grazed the outer banks of North Carolina. Meanwhile, Typhoon Yancey was headed toward Okinawa and Japan, lashing out with high winds and heavy rain. I certainly hope that David Cowhig, Ambassador to Okinawa, and the rest of the people will be safe and secure.

I made it back to Colorado this summer, but wasn't able to have an eyeball with any of the Gunnison hams. I did find out that the tri-band beam received from Fran, the widow of Fred Palmbad W0CYM, was used during the Field Day operation, and that a plaque has been permanently placed on the beam by the Gunnison Valley ARC. Fran's generosity has certainly started me thinking about what amateur-related equipment I might leave to local hams or the local ham club to help further this fantastic hobby. I have already compiled a list and am planning to include it in the next update of my Last Will and Testament. I think that this is really a way that we can all get involved, but in a slightly different way. Think about it! Lastly, I am very happy to introduce a new Ambassador from the Philippines, Lorenzo D. Gaston DU1CHD/6. He sent along three submissions for our pleasure. Welcome, Lorenzo! That's all for this month. On to the great news from around the world! 73, Amie N1BAC.

Roundup

Dominican Republic Letter from Bill Meara N2CQR/HI8: Greetings from Santo Domingo, capital of the Dominican Republic ("The DR" for short), land of sunshine, merengue music, and FB ham radio! The members Radio Club Dominicano have authorized me to serve as '73 International's Dominican Republic Correspondent. I am on assignment with the U.S. Embassy here; my selection as correspondent was based largely on my more than 30 years of practice with the English language! We've seen the excellent reports from around the world and wanted to send in a contribution from the DR.

The Dominican Republic is located on the eastern two-thirds of the island of Hispaniola. We are on the large island between Cuba and Puerto Rico. The country has a population of over seven million and is Spanish-speak-

ing. French-speaking Haiti occupies the western third of the island.

Ham radio is big in the DR! A drive through Santo Domingo reveals numerous HF yagis. Radio Club Dominicano (HI8RCD) is the IARU affiliate and has been in operation since 1926. The club sports a complete HF station, along with 2 meter gear and packet equipment. A second club, Union Dominicano de Radio Aficionados, is also very active in Santo Domingo. In the country's second city (Santiago) there is much club activity, including the Hotel India DX Association.

Dominican hams are involved in a wide variety of radio operations. HF SSB DXing is the most popular. Geography has blessed the island with good DX conditions (we are surrounded by salt water and have abundant solar radiation!). There are approximately one million Dominicans living in the U.S. (mostly in the New York area), and amateurs among this expatriate population maintain schedules with ham friends on the home island. There is a lot of 2 meter FM activity, and the packet revolution has also swept through HI land. There is a small group of 6 meter enthusiasts providing a new country for VHF buffs. Hams here have worked the Mir space station, and there is interest in the satellite program.

The numbers after the HI prefix indicate geographic region (8 for the capital, 3 for Santiago, etc.). The suffix letters are usually based on the ham's initials. Old-timers are authorized single-letter suffixes. Foreigners operating with Dominican licenses have suffixes that begin with X. The DR has a reciprocal license agreement with the U.S.; hams operating under this agreement work with their home call, followed by /HI. ARRL headquarters has up-to-date information on the fairly simple process for obtaining reciprocal operating permission.

While not really in the category of rare DX, an HI call can stir up some pile-ups on the HF bands—lots of fun for a visiting U.S. ham.

Tourism is one of the country's largest industries, and we are sure that there are hams among the million or so sun-seekers who visit the DR's beautiful beaches every year. While most of the resort areas are quite distant from Santo Domingo, tourists do frequently make it to the capital. If you're coming to Santo Domingo, drop us a line, and we'll see if a visit to the club can be arranged.

Dominican hams are very friendly to hams from across the sea. HI8RCD currently has members from the U.S. and Japan. Over the years, foreigners on assignment in the DR have been very active in the local club.

We will try to provide '73 International' with periodic updates. For now, best of 73 from HI8!

[Bill Meara N2CQR/HI8, Unit 5510, APO AA 34041 USA]

Russia From Yuri V. Funkner, UN9LX (ex-UL7LS): The International Diploma Foundation is a nonprofit, volunteer effort devoted to the development of world amateur radio by means of establishment of various awards. Membership is open to anyone who shares the objectives of the foundation and is ready to pay the entrance fee. Donors will receive handsome certificates. All gifts will be acknowledged. For further information, write to: Yuri V. Funkner UN9LX, IDF Secretary, PO Box 1 Frunze 459411, Ordzhonikidzevskiy Rayon, Kustanayskaya Oblast, Republic of Kazakhstan. [Yuri also hosts a DX Net on 7043 KHz on Friday at 1900 UTC.]

Switzerland From the International Telecommunication Union (ITU) Press: The ITU has created a new strategic consultative body to step up telecommunications development worldwide. The Telecommunication Development Advisory Board (TDAB) held its first meeting on 6 and 7 July 1993 to advise ITU on priorities and strategies for telecommunication development, to advise ITU member countries on how best to step up telecommunications development and to reinforce the role of the development machinery of the Union in this area.

The board will neither exercise supervisory functions nor will it be involved in the management of ITU's development sector. It will, however, be required to:

- Provide views and recommendations that will contribute towards the development, expansion and efficient operation of telecommunications;
- Help in raising the level of awareness of decision-makers of the importance of telecommunications in socio-economic development of nations;
- Encourage the participation of industry, telecommunication operators and service providers, bilateral and multilateral organizations and financing institutions to promote telecommunications development in developing countries;
- Assist in the mobilization of actions and resources for pre-investment and investment activities in the field of telecommunications;
- Assist in the preparation of telecommunication development conferences.

U.S.A. From Patrick G. Lehrman N9JPV: The June issue of *Radio Fun* ran an article about the "School-to-School OSO Contest." Many schools, hams, and clubs in the U.S. and Canada have responded to that article. The contest started at 1200 UTC on October 5 and ran through 1200 UTC on October 6, 1993.

Please send photocopies of logs as well as any interesting stories to the Westmont Amateur Radio Club by December 31, 1993, at 125 S. Grant St., Westmont IL 60559-1907 U.S.A. [This letter described the contest but arrived too late to be included in the October issue before the contest.—Amie]

CANARY ISLAND: SPAIN

Woodson Gannaway EA8/N5KVL
Apartado 11
35450 Sta Madre Guia (G.C.)
Islas Canarias
Espana

Well, the Amateur Radio Congress held in Las Palmas last fall, came great. We had hoped for more foreign participation, but about the only foreigners who showed up were the vice president of the French amateur radio organization and his wife, a Portuguese couple, and some Russians who sailed here in a Viking-type ship (I would be worth a story in itself) so months earlier. There was a wide array of activities, excursions, and such which they pulled off with the usual flair. This was another event in which a good time was had by all. More recently, it hosted a CW contest weekend. I'll have to get up that hill again to see what they're planning next.

In a previous report, I mentioned learning to make Canary knives so could know what I was talking about when I wrote about them. I suppose that is a worthy motive, but it certainly doesn't guarantee that if someone has experience, that they can then write clearly and correctly about a particular subject.

In a different report, I mentioned something about heroes in the mold of old. What I had in mind was heroism of moral courage instead of physical courage. People who can inspire us by the moral nobility they display under extraordinarily difficult circumstances. Isn't this what we need today? Certainly not more mercenaries, as noble as that is under certain circumstances. What I think of is people like Matthew Henson, who accompanied Peary in his achievements in the Arctic. We may be more than accompanied Peary referred to him as "indispensable, more of an Eskimo than some of them," and he is still greatly admired by the descendants of the Eskimos among whom he moved. "K Matthew" he was known among them, and my favorite photograph is of him holding a muskox calf in his arms (National Geographic Vol. 174 No. September 1988, p. 422).

He became one of the great hunters and sled drivers of all-time of living out his life as a shepherd's son he was. There is doubt that he had tremendous physical courage, but he also had more. Loyalty, humility—you might say reading his story.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel
Packet: 4X1MK @ 4Z4YU.ISR.
MDLE

About 40 amateurs were present at Natanya's Goldar Hotel for the annual Israeli Packet Group's meeting.

opening address was given by pioneer packeleer Bentzi 4X1IL, while the Hannukah candles were lit by Yankel 4X1AH, IARC President. Further talks on subjects related to packet radio were made by Yossi 4X6KJ, IARC Chairman, Naftali 4Z4RM, and "Dima Danny" 4Z9DDA.

The Packet Cluster, which shall soon start operation on 144.675, the 4XNet frequency, was discussed by 4X1IL, 4X1GP, and 4X1DA. The first Cluster's callsign will be 4X4BX, in memorial to the late DXer Sioma Manzari 4X4BX, who was the first IARC chairman. Hot DX information will be transmitted to all Cluster members who have left their packet gear on the frequency in the same manner as in a telephone conference call.

Jim 4X1RU outlined the newest version, 5.14, of the F6FBB BBS program, which is installed in his BBS and requires one megabyte of computer memory. Mail from abroad comes through 4X1AS's satellite gateway and six European HF BBSs. Features of the new software are: a BBS data base which completes incomplete addresses automatically, a REJECT file to zap undesirables, and an SR (Send Reply) feature that automatically addresses according to the number of the message being answered. Jim also reviewed the amateur communications software being integrated into the Technion's satellite project, the Techsat.

Peleg 4X1GP clarified points on proper packet operation stressing the inclusion of one's own packet forwarding address in the body of the message, so that the addressee will know how to reply. Recommended operating parameters for the TNC dealing with switching time and delays for proper integration into the Net were discussed.

He also explained the TCP/IP protocol and the latest improvements made in it. He recalled the problem of the "hidden station" that reduces the through-put in the system to 18% of the capacity. He presented a solution where a commanding station will work as a digital regenerator transmitting what it's receiving simultaneously. This will raise the efficiency to 56% at the cost of allocating two frequencies to communication.

Shlomo 4X1AS described the communications programs (PG and PB) for working on the satellites OSCAR 16 (1200 baud) and OSCAR 22 (9600 baud). Messages are sent in the BROADCAST mode, and the satellite can be utilized by up to 20 users simultaneously. If 20 are already connected, you are given a number and must wait in line until your turn comes up. The satellite transmits 10 seconds to each connectee. Material stays in the satellite from two to four days and the local directory should be constantly updated. If the requested information is not received in the present pass, the program will automatically request it again when the bird comes overhead the next time. Files arrive in compressed form and as such are

transferred to 4X1RU, where they are unraveled. There are 25 satellite gateways in the world. Each one receives material only from other gateways and checks the satellite's directory if there are any messages for it.

All-in-all, this year's Packeteers' meeting was a fruitful one, giving a good forum for the exchange of ideas and furthering the advancement of the fast-growing field of digital communications in Israel. Looking back to the inception of packet in Israel a mere six years or so ago, the growth has been amazing. [Also amazing in the rest of the world too!—Amie]

OKINAWA JAPAN

David Cowhig 7J6CBQ/WA1LP
AmCon Naha
FBU PSC 556, Box 840
FPO AP 96372-0840

Now it is late June. The plum rain season has ended and we are moving into Okinawa's hot season. Soon will come the Eisa festivals throughout Okinawa (July and August) where the Okinawans, who follow the ancestor-veneration religion of the Chinese, welcome back the spirits of their ancestors for a three-day visit. Large groups of men and women dance in fine costumes, some carrying drums like those shown in JS6ANO Hokama-san's QSL card. The instruments and distinctive rhythms of Okinawan music, very different from those of the rest of Japan, owe much to Indonesia, Thailand, China and probably India as well.

When Emperor Akihito and Empress Michiko visited Okinawa in April they passed just 200 meters from our house in the central Okinawan village of Kitanakagusuku on their way to visit some handicapped children. Our neighbors waved Japanese flags as the couple drove by in their black limousine and helicopters circled overhead. Not to be left out, my children, Patrick and Frances KD4BMJ, grabbed Japanese flags and waved them enthusiastically as the Emperor and Empress passed by. I couldn't help but think what a wonderful difference 50 years makes!

One theme of the Emperor's visit for the National Arbor Day Celebration was reconciliation with the Okinawan people who had suffered terribly at the hands of the Japanese Imperial Army. Today, as they do every June 23, Okinawans remember the 200,000 Japanese, Americans, and Koreans who died here in 1945. The Okinawans plan to dedicate a memorial on the 50th anniversary of the Battle of Okinawa, which will have the names of all the soldiers—Japanese and American—who died in the battle. In the words of Jana, the 17th century Ryukyu Kingdom statesman, "inochi da takara"—"life is treasure."

During a mid-May trip to Yonaguni, the westernmost of the Japanese islands and home of the world's largest moth (wingspan up to 24 cm!), my efforts to reach Taiwan, just 80 miles, on 2 meters failed but I met island physi-



Photo A. QSL card of JS6ANO, showing dancers welcoming back the spirits of their ancestors.

cian Masaki Akamine JS6GNM, his wife Mimako JS6KHO and their two children. The Okinawa Prefectural government assigns Akamine-san to a new outlying island every two years. He likes islands so he started his assignment on Yonaguni, population 1800, in May 1993. I met JS6GNM on the 80-miles-distant 439.88 MHz JR6YI Ishigaki island repeater but soon switched to 2 meters simplex and then the eyeball mode since Akamine-san's home (and clinic) was just 50 meters from my minshuku (Japanese traditional-style hotel). The Akamines took me on a tour of the island while I worked in Honshu using his 3 watt Mizuno 21 MHz SSB handie talkie. We finished the evening in a restaurant run by Yonaguni Mayor Tsuimaji's family—named the White House, naruhodo (that's, of course, in Japanese).

Yonaguni lives by raising beef cattle, growing sugar cane and vegetables, fishing, selling the local awamori rice liquor (at 60% alcohol the strongest brew in all Japan), and tourism. Yonaguni enjoyed a brief boomtown era (the island population hit 12,000 in 1947) as Japan's Wild West just after World War II. Enterprising smugglers liberated goods from the US military PX for cheap Taiwan rice which they could sell for a 700% profit on the Japanese black market. [More next month!—Amie]

PHILIPPINES

Lorenzo D. Gaston DU1CHD/6
PO Box 27
6116 Silay City, Neg. Occ.
Philippines

Amateur Radio licenses in the Philippines are issued by the National Telecommunications Commission (NTC). NTC is under the Department of Transportation and Communications (DOTC). NTC is headed by one commissioner and assisted by three deputy commissioners. The NTC issues Amateur Radio Licenses and Radio Amateur Operator's Certificates with a maximum effectivity period of three years.

There are four classes of amateur radio licenses in the Philippines: Class

A, B, C, and D.

Class A licensees have full privileges and their authorized station power output is limited to 2 kW PEP SSB or 1 kW CW. Class A licensee who have operated for at least five years as Class A are qualified to be either appointed as club station Trustees or deputized by the NTC as Amateur Radio Inspectors or both. Class A licensees are assigned D-prefixes, but they are also given one option to change the callsign prefix from DU to either 4D, 4E, or 4F. A club station is required to have (qualified) Trustee. Licenses to operate repeaters are only granted to duly recognized amateur associations, clubs, or societies. All club stations and their repeater(s) have the same callsign and are assigned DX prefixes.

Class B licensees are not authorized to transmit on the 160 meter band. Operation on 20 meters is a lowed except on the segment from 14.100 to 14.275 MHz. Operation on all other bands and modes are a lowed and authorized station power output is limited to 1 kW PEP SSB or 500 watts CW. All Class B licensees are assigned DU prefixes.

Class C licensees are authorized transmit on all modes on 40, 15, 1 and 2 meters only. Authorized station power output is limited to 200 watt PEP SSB, 100 watts CW, and 1C watts on 2 meters. All Class C licensees are assigned DU prefixes.

Class D licensees are limited to meters only (all modes) and 100 watt power output. All Class D licensees are assigned DY prefixes (DY-prefix QSL cards are not valid for the UN-CD Award or any other award so please do not contact or send a QSL card a DY-prefix station on any band except 2 meters, just in case you hear one).

A "Radio Amateur Operator Certificate" is a certificate of authority issued by the NTC to a qualified person who has passed an appropriate amateur radio examination. This certificate authorizes the holder to operate any licensed amateur radio station of an appropriate class as indicated in the certificate.

Next month I will cover the reciprocal licensing in the Philippines. 73! E

SPECIAL EVENTS

Number 21 on your Feedback card

Ham Doings Around the World

NOV 7

KAUKAUNA, WI The Fox Cities ARA will hold a Ham and Computer Fest at the Starline Club. VE Exams. Talk-in on 146.76 (CTCSS 107.2 Hz). For details, contact Dan Vanevenhoven N9LVS, 2410 E. Newberry, Appleton WI 54915. Tel. (414) 739-5101. VE Exams, contact Larry Siebers KD9IA, (414) 788-3823.

NOV 13

MONTGOMERY, AL The Montgomery ARC will host the 16th annual Montgomery Hamfest/Computer Show in Garrett Coliseum at the South Alabama State Fair grounds on Federal Rd. from 8 AM-3 PM CST. VE Exams start at 8 AM. Talk-in on 146.24/84 (W4AP). Ragchew on 146.32/92 (with phone patch, up/down), 147.78/18, 449.50/444.50. Special Rates: Days Inn, (205) 269-9611; Coliseum Motel, (205) 265-0586 or (800) 876-6835; or Best Western Regency Inn, (205) 260-0444/(800) 528-1234. Contact Hamfest Committee, c/o 111 Diane Dr., Prattville AL 36066, or phone Jiggs, (205) 365-0380. FAX (205) 264-1150.

PLYMOUTH, MA The Mayflower ARC will host a Flea Market at the Plymouth Memorial Hall Bldg. in Plymouth Center (RT3A), from 9 AM-3 PM. Walk-in VE Exams. Talk-in on 446.625- and 146.55 simplex. For Flea Market info, call Jon W5IK, (508) 746-0162 or Jim NM1F, (508) 747-2224 eves. For exam info, call Bob, (508) 747-6022.

NOV 13-14

FORT WAYNE, IN The Fort Wayne Hamfest/Computer Expo and 1993 Indiana ARRL State Convention will be hosted by the Allen County AR Tech. Soc., Inc., at the Allen County Memorial Coliseum. Expo. Times: Sat. 9 AM-4 PM; Sun. 9 AM-3 PM. VE Exams, Forums, Meetings. Talk-in on 146.88-. For table info call (219)-483-6305. For details, call (219) 484-3317.

NOV 14

BRANFORD, CT The Southcentral Conn. ARA will hold its 14th annual Flea Market at the Branford Intermediate School, 185 Damascus Rd., starting at 9 AM. VE Exams—reservations must be mailed to be received before Nov. 1st. Talk-in on 146.01/61. For details, call Brad, (203) 265-9983, 24 hrs. Mail reservations with SASE to SCARA, P.O. Box 705, Branford CT 06405-0705.

CHICAGO, IL The Chicago ARC will hold the Fall Ham Auction at the DeVry Inst. of Tech., 3300 N. Campbell, starting at 12 noon, until all is sold. Door opens at 10 AM for inspection of items.

NOV 20

BILLERICA, MA An Amateur Radio and Electronics Auction will be held from 11 AM-4 PM at Bull HN, 300 Concord Rd. Talk-in on 147.12. Seller Check-in at 9:30 AM. Item inspection at 10 AM. Sponsored by BULL HN 1200 RC and Waltham ARA.

NOV 21

BENSON, NC The Johnston ARS, Inc., will hold its annual "Jarsfest" at the American Legion Complex from 8 AM-4 PM. Contact Bill Lambert AK4H, 8917 NC 50 N., Benson NC 27504. Tel. (919) 894-3352 eves. 7 PM-10 PM.

WASHINGTON, PA Washington Amateur Communications (W.A. COM) will hold its 6th annual Tri-State Hamfest/Computer Fair from 8 AM-3 PM, at Charters-Houston H.S. VE Exams. Talk-in on 145.49-W3CYO/R. Contact Ted Lockman WB3BZK, (412) 222-6473; Russ Burhenn N3NEL, (412) 222-4037; or FAX (412) 258-8342. Or write W.A. COM, P.O. Box 1386, Washington PA 15301.

NOV 27

EVANSVILLE, IN The ALL NEW Evansville Winter Hamfest, sponsored by EARS, will be held at the Vanderburgh County 4-H Center, Highway 41 (just north

of Evansville). Doors open at 8 AM. Contact Beverly Hensley KA9PDG, (812) 475-5741. Talk-in on 145.150 in Evansville on 146.925 in Vincennes. Send reservation to EARS, 1506 S. Parker Dr., Evansville IL 47714.

NOV 28

WHEATON, IL IL-GMRS of Illinois, Inc. will hold their annual "Winterfest" from AM-1 PM at the DuPage County Fairgrounds in Wheaton. Call (708) 690-149, or write GMRS, 2077 W. Roosevelt Rd Wheaton IL 60187.

DEC 4

NORTH OLMSTEAD, OH The North Coast ARC will hold their Fall Hamfest from 8 AM-2 PM at Saint Clarence Church 30106 Lorain Rd. Electronics. Computer Talk-in on 145.29 and 224.76 Rptrs. Contact Dan Sarama KB8A, NCARC President, (216) 267-5083; or Rick Mac NBVKE, (216) 483-4818; also, NCAR Packet BBS N08M.

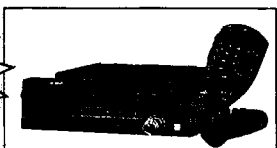
SPECIAL EVENT STATIONS

NOV 4

CLINTON, NC The Sampson County AR will operate K4OAR from the Sampsc County Expo., from 1700Z-2400Z; low portion of the General bands. For a certificate, send QSL and SASE to SCARS, P.O. Box 64, Clinton NC 28328.

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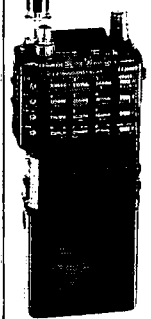
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NOV 6-7

OLTON, VT The Central Vermont ARC will operate the Vermont Girl Scout Council E Station W1BD from the Bolton Valley resort, 1700Z Nov. 6th-0200Z Nov. 7th. req.: 14.233, 7.233, 3.865 MHz. For a special Event QSL card, send QSL and ASE to CVARC/VGSC Special Event, c/o Box 674, Montpelier VT 05602-0674.

EW HAVEN, CT The South Central CT RA will operate W1GB 1400Z-2300Z to commemorate the operation of the first telephone switchboard in the U.S. Operation will be in the General 40 and 20 meter subbands. For a certificate, send QSL and 9" x 12" SASE to Bruce Torello AA1BX, 94 Dogwood Rd., Orange CT 06477.

NOV 6-11

UELPH, ONT., CANADA SE Station G3W will operate on 10, 15, 20, 40 and 80 meters as an "in memoriam" for the fall of both World Wars. Operation will be 11 AM-5 PM EST each day, with a minute silence at the 11th hour of the 11th day of the 11th month. For a QSL card, send IRC or Canadian Postage on SASE to G3W, c/o VE3ZM, P.O. Box 1305, Uelph, Ontario, Canada N1H 6N9.

NOV 11-12

LBUQUERQUE, NM The Albuquerque RC will operate WB5MI from 1700Z Nov. 11-1700Z Nov. 12th, to commemorate Veterans Day. The Station is located at the Veterans Administration Medical Bldg. For certificate, please send a QSL and a 9" x 12" SASE to AARC, P.O. Box 11853, Albuquerque NM 87192.

NOV 13-14

CHARLOTTE, NC Mecklenburg ARS will operate W4BFB from 1400Z-2400Z Nov.

13th, and 1800Z-2400Z Nov. 14th, to celebrate the 2nd Anniversary of the amateur radio education center at Discovery Place, the hands-on science museum in uptown Charlotte. Operation will be in the lower 25 kHz of the General 80, 40, and 20 meter phone subbands; as well as in the Novice 10 meter phone subband. For a certificate, send a 9" x 12" SASE to Mecklenburg ARS, 2425 Park Rd.-Room 023, Charlotte NC 28203-5974.

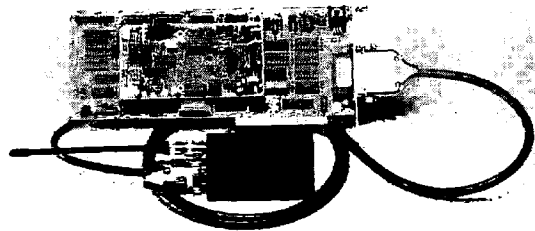
COLLEGE PARK, MD The Laurel, MD ARC will operate W3DQI FROM 1700Z Nov. 13th-2100Z Nov. 14th, from College Park Airport. Operation will be in the lower portions of the General bands, near 28.5 in the Novice subband, and on 147.5 FM. For a certificate, send QSL, 9" x 12" SASE, and your QSO nr to LARC, P.O. Box 3039, Laurel MD 20709-0039.

STUART, FL Martin Co. Ares/Races will operate WA2TRJ 1400Z-2200Z both days, from the 6th annual Jensen Beach Pineapple Festival. Operation will be on the lower portion of the General 10, 15, and 20 meter bands. For a certificate, send QSL and a 9" x 12" SASE to Larry Cohen WA2TRJ, 5595 SE Lamay Dr., Stuart FL 34997.

NOV 19-21

FORT LANGLEY, B.C., CANADA The Fraser Valley ARA will operate VF7L from Fort Langley, to commemorate the 135th Anniversary of the Proclamation read by Sir James Douglas at Fort Langley, Nov. 19, 1858, creating the Colony of British Columbia. Operation will be on the 20, 15, and 10 meter bands in the General portions, from 1700Z to 2300Z over the 3 days. For a certificate, send QSL and a 9" x 12" SASE (or \$1 to cover postage), to Fraser Valley ARA, Box 50, Fort Langley, BC, V0X 1J0 Canada.

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Marjorie Swain with Grand Prize won at 1992 Symposium - a Kenwood TR-751A all-mode 2 meter transceiver. OM Carroll W7DU seems pleased with her good fortune.

For more information
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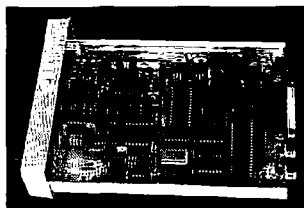
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NEW PRODUCTS

Number 22 on your Feedback card

Compiled by Charles Warrington WA1RZW



MULTIFAX

The new MultifAX external WEFAX demodulator is now available, and it can be used anywhere with an IBM or compatible PC, Laptop, or Notebook. The unit interfaces directly through the

parallel printer port; it does not require its own internal slot.

This external unit uses the same software and supports the same features as the popular MultiFAX Version 2.2 plug-in card. The unit runs on any 12 VDC supply, including cars and boats. Now you can downlink NOAA satellite weather imagery wherever you go.

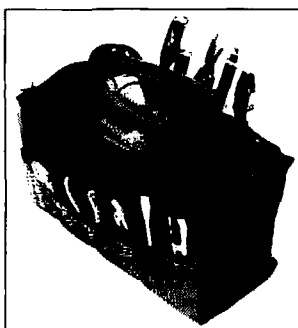
The price is \$389 plus \$8 S & H in the U.S. (The unit is shown with its cover removed.) For further information, contact: *MultiFAX 143 Rollin Irish Road, Milton VT 05468; (802) 893-7006, FAX (802) 893-6859.* Or circle Reader Service No. 202.

PAKTEK

PAKTEK has introduced the "Tool Tote" as their unique solution for the two biggest complaints about hard utility boxes: 1) They are clunky; and 2) They damage surfaces. The new-fashioned Tool Tote is strong but gentle.

This handy soft-sided utility organizer features an over-sized center compartment opening for easy access, 14 external pockets, an extra-large zipper with two pulls, bold red and black styling, and an affordable price of \$24.97.

For more information or to place an order, contact: *PAKTEK, Inc., 7307 82nd St. Ct. SW, Tacoma WA 98498;*



(800) 258-8458. Or circle Reader Service No. 201.

JADE PRODUCTS, INC.

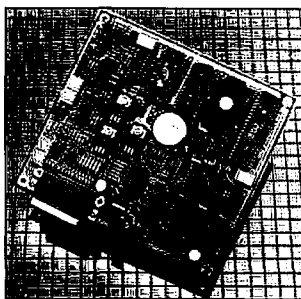
Here's the latest addition to Jade Products FUN-KIT line: the 160 Meter Twin-Lead Marconi Antenna. This antenna (Model AN-00001-01) is a complete, ready-to-install kit consisting of all the necessary hardware, wire, twin-lead, connectors, and support rope.

This antenna provides unique support for the twin-lead, thus preventing the failure due to fatigue and flexing which often occurs when hanging twin-lead by rope. This elbow support forms a gradual bend, and is adjustable. The antenna is approximately 126 feet long. With the elbow elevated to 35 feet, the horizontal section would require only 90 feet.

Installation and connection is simple; an antenna tuner is not required.



The price is \$39.95. To order or for more information, contact *Jade Products Inc., P.O. Box 368, East Hampstead NH 03826; (603) 329-6995.* Or circle Reader Service No. 206.



S-COM INDUSTRIES

S-COM Industries is now shipping a powerful 100-setpoint scheduler as a standard feature on all 5K Repeater Controllers. The scheduler executes user-defined macro commands at programmable setpoints (times and dates). The macro commands determine the action the controller will take, such as changing repeater access modes for day and night, and reprogramming the identifier for holidays and special events, etc. These can be set for a specific time and date, or for events recurring on a regular basis.

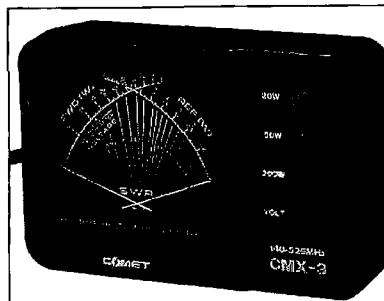
The controller automatically com-

NCG COMET

New from Comet, this compact Cross Needle SWR/Power Meter has its metering separate from its RF sensor. Three models are available for high power HF, low power HF/VHF, and low power VHF/UHF. The Cross Needle design provides forward and reflected power and VSWR simultaneously.

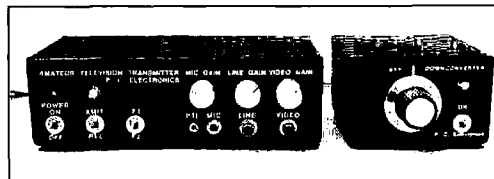
Three-switch selectable power ranges are provided on each model, with a fourth switch to measure DC voltage from the power supply or vehicle. The meter is lighted in color for easy reading.

The CMX Meter Series is specifically designed and ideally suited to mobile operation. Each meter comes with a standard six-foot cable allowing placement of the meter head near the



rig's remote head, while the sensor near the rig itself. An optional 10-ft extension is also available.

The CMX Series is available from your amateur radio dealer. For more information contact: *NCG Company 1275 North Grove St., Anaheim CA 92806; (800) 962-2611, FAX (714) 630-7024.* Or circle Reader Service No. 204.



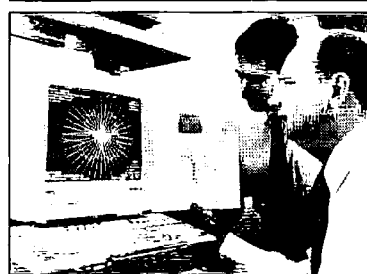
P.C. ELECTRONICS

Here's a low-cost progressive way of getting into ATV: the P.C. Electronics Model TX70-1b 1.5 watt 70 cm (420-450 MHz) Transmitter. Many start by purchasing the \$89 TVC-4G Tunable Down Converter just to check out the local ATV repeater or simplex action. After the ATV bug bites, they are ready to transmit back. But now, instead of trading for an all-in-one-box transceiver, they can just add the companion TX70-1b Transmitter for \$279.

The transmitter's rugged die-

cast aluminum case is lightweight, less than two pounds, and is strong enough to easily fit in a knapsack. The unit comes with one crystal that has provisions for switching between two frequencies. The external power requirements are 12 to 14 VDC at 5 mA. The antenna connector is a TNC; a BNC outputs to the receiver down converter from the built-in power T/R relay.

No-code Technician Class or higher amateurs are welcome to write or call for a 10-page catalog. Please contact: *P.C. Electronics, 2522 Paxson Lane, Arcadia CA 91007; (818) 447-4565.* Or circle Reader Service No. 205.



ANTENNA SPECIALISTS

The Antenna Specialists Co. has developed a new set of software programs to aid communication system designers and operators in producing critical base antenna calculations and patterns tailored to their own system requirements. Called the RF Tools Series, the programs are said to be both highly accurate and easy to use.

Disk 1, called DXPLOTT, permits precise calculation of beam tilt coverage,

penetrates for power outages and leap years. The 5K Repeater Controller is priced at \$175. Options and upgrades for older models are available. For

Disk 2, called PATPLOT, calculates and plots digitized base antenna patterns. Disk 3, called ANTIPLOT, develops patterns for side-mounted base antennas. These programs are available on 5-1/4" IBM compatible disks, but the programs can also be downloaded, free of charge, from the manufacturer's remote bulletin board system (RBBS). The A/S RBBS is online 24 hours a day and offers

an enormous bank of technical product information, files capability, and help utilities, and listings of technical and engineering support staff. The modern communications mat is 300/1200/2400/9600-N81. Number is (216) 349-8698.

For further information contact: *Antenna Specialists Company, 30 Bruce Industrial Parkway, Cleveland OH 44139-3996; voice (216) 384-000, Fax: (216) 349-8407.* Or circle Reader Service No. 203.

For more information, contact: *S-COM Industries, P.O. Box 1718, Loveland OH 43039-1718; (303) 663-6000.* Or circle Reader Service No. 206.

David Cassidy N1GPH

Giving Thanks

It is approaching that time of the year when we are supposed to reflect upon our lives, and ponder the things for which we should give thanks. When I sit down to that Thanksgiving meal, here are some of the things that I'll be giving thanks for.

First and foremost, thanks to Wayne Green for his continued trust, guidance and example. I have learned more about marketing and publishing in the last three years than I did in the previous 10. We don't just talk about things here at WGI, we do them. It is Wayne's leadership that fosters this type of entrepreneurial spirit, and makes it a pleasure to come to work in the morning.

I also need to thank the staff of 73. Less than a dozen people put out this magazine (as well as *Radio Fun*), and I can honestly tell you that I have never worked with a more talented group of people (and I've been lucky to have worked with some pretty talented folks). We are truly a team, and I think it shows in the quality of our magazine. I hope you agree.

"Lots of people won't admit it, but the no-code license has single-handedly kept the amateur radio industry from feeling the worst of the economic difficulties of the last few years."

Thank you to the columnists and writers who grace us each month with their talents. I am continuously amazed at how good our writers are! I truly believe that 73 has the finest group of columnists and regular contributors of any magazine in the electronics field. If you doubt me, go ahead and do a side-by-side comparison with any other magazine. It ain't bragging when it's true.

Thank you to the ARRL. Yup... I said the ARRL. Regular readers of this column might be asking themselves, "Why is Dave thanking the organization that he spends so much time criticizing?" First of all, I am *not* anti-ARRL. I believe that the League is the only organization that is capable of representing the interests and ensuring the future of amateur radio. I just wish they would do it! I'd like to thank the gang in Newington for providing me with so much material over the last few years. We can only hope the day will come when this will no longer be the case.

We should all thank the FCC for the new Technician Class license. While we're at it, let's send a hearty "thanks" to all of the Techs (and all the other newcomers) who have received their licenses this year. Lots of people won't

admit it, but the no-code license has single-handedly kept the amateur radio industry from feeling the worst of the economic difficulties of the last few years. The no-coders have also revitalized many ham clubs across the country. Contrary to what the Tech-bashers have been crying, those who have entered our ranks via the Technician Class license are learning the code and upgrading at a phenomenal rate. Take a good, hard look folks, because this is the future of amateur radio.

Thanks go to the companies who advertise with us. I have never worked in an industry where I consider so many business associates friends. We've had quite a few advertising success stories over the last few years, and I'm happy that more and more companies are waking up to the fact that 73 readers are their biggest source of potential customers.

Thanks to the 30,000 (and growing) of you who send us your \$20 every year to subscribe. It is for you that we fight deadlines, scrutinize every word, draw figures, paste up ads... and

then do it all over again 30 days later. Your letters tell us that you appreciate our efforts, and you let us know when we've fallen short of our own high standards. More thanks to the over 20,000 (and growing) of you who plug down your \$2.95 every month to buy 73 on the newsstand.

Thanks to those of you who take the time to stop by the 73 booth at hamfests. You have no idea how helpful it is to have face-to-face discussions with our readers... and our non-readers. You remind us that, more than most magazines, the relationship we have with our readers is a phenomenon in the publishing industry. That goes double for *Radio Fun* readers. It is a relationship that we here at the home office truly cherish and strive to live up to.

Finally, thanks to all of you who read "Random Output," especially those who choose to write and comment on my monthly musings (even those who think I should shut up and stop bothering people). Your opinions are of vital importance, and it helps immeasurably to know what you are thinking. A magazine column is so often a monologue. You folks make it more of a dialogue, and that makes all the difference.

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

You can expect November conditions to be generally Fair (F) to Good (G) this month, except for the week between the 16th and 23rd when conditions are expected to be Poor (P) to Very Poor (VP), particularly on the 18th and 22nd. During this week there may be geophysical disturbances in the atmosphere as well as the ionosphere, so be aware of possible heavy storms of rain or snow and other effects such as volcanism, earthquakes, and the like somewhere on earth. Pay particular attention to your local radio and TV stations during this week with announcements of local weather conditions.

November is a month when propagation is trending from the generally good DX outlook of September and October to the generally poorer DX conditions of November, December, and January. The higher frequency bands above 20 meters are likely to close early (at sunset or shortly thereafter), and the lower frequency bands below 20 meters will be open after dark and until the early morning hours. Except for the days on the chart marked Poor or Very Poor, you will find the low atmospheric noise and the wide-open 160, 80, 40, and 30 meter bands to be a big change from summer and fall.

As you know, the sunspot numbers are declining each month, with only an occasional spurt of solar flux above the 100 level. The sunspot minimum is now predicted for sometime in late 1996 or early 1997... with a good possibility that an even earlier minimum may occur. During these times of sunspot inactivity there will be fewer openings for DX on the HF bands. Keep an ear open for DX to Europe in the morning hours local time, and to the Pacific in afternoon hours on the 10, 12, 15, and 17 meter bands. Midday openings to South and Central America and Africa may be possible on some days

this month. Short skip within the U.S. will prevail on Good (G) days. The meter band will be the mainstay of DX this month, with occasional surprises on the higher bands. Twenty v show openings to all parts of the world on Good (G) days until well after dark.

The 40 and 80 meter bands (and meters, too) will be very good for DX to Europe in the evening hours, and the Pacific during the early morning hours around sunrise. Eighty meters may well be the choice of DXers for the next couple of months, so make sure your antennas for these bands are running at optimum performance.

On 160 meters, there will be little activity until around sunset and aft throughout the evening hours a peaking toward Europe around midnight. Openings to the Pacific and south and west will be best around sunrise. You will enjoy very low atmospheric noise and strong signals. See you next month!

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20
ALASKA	15	15	20	20	20	-	-	-	-	-	-
ARGENTINA	15	15	20	20	20	-	-	-	-	-	-
AUSTRALIA	10	15	20	20	20	-	-	-	-	-	-
CANAL ZONE	15	40	40	40	40	-	-	-	-	-	-
ENGLAND	20	40	40	40	40	-	-	-	-	-	-
HAWAII	10	15	20	20	20	-	-	-	-	-	-
INDIA	20	20	-	-	-	-	-	-	-	-	-
JAPAN	15	20	20	20	20	-	-	-	-	-	-
MEXICO	15	40	40	40	40	-	-	-	-	-	-
PHILIPPINES	-	-	20	20	20	-	-	-	-	-	-
PUERTO RICO	15	40	40	40	40	-	-	-	-	-	-
SOUTH AFRICA	40	20	20	20	20	-	-	-	-	-	-
U.S.S.R.	-	-	40	20	20	-	-	-	-	-	-
WEST COAST	10	15	20	20	20	-	-	-	-	-	-

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20
ALASKA	10	15	20	20	20	-	-	-	-	-	-
ARGENTINA	15	15	20	20	20	-	-	-	-	-	-
AUSTRALIA	10	15	20	20	20	-	-	-	-	-	-
CANAL ZONE	15	15	20	20	20	-	-	-	-	-	-
ENGLAND	-	-	-	-	-	-	-	-	-	-	-
HAWAII	15	15	20	20	20	-	-	-	-	-	-
INDIA	-	20	-	-	-	-	-	-	-	-	-
JAPAN	10	15	20	20	20	-	-	-	-	-	-
MEXICO	15	15	20	20	20	-	-	-	-	-	-
PHILIPPINES	15	-	20	20	20	-	-	-	-	-	-
PUERTO RICO	15	15	20	20	20	-	-	-	-	-	-
SOUTH AFRICA	20	20	20	20	20	-	-	-	-	-	-
U.S.S.R.	-	-	20	-	-	-	-	-	-	-	-

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20
ALASKA	10	15	-	-	-	-	-	-	-	-	-
ARGENTINA	10	15	15	20	20	-	-	-	-	-	-
AUSTRALIA	10	15	15	20	20	-	-	-	-	-	-
CANAL ZONE	10	15	15	20	20	-	-	-	-	-	-
ENGLAND	-	-	-	-	-	-	-	-	-	-	-
HAWAII	10	15	15	20	20	-	-	-	-	-	-
INDIA	-	20	-	-	-	-	-	-	-	-	-
JAPAN	10	15	-	-	-	-	-	-	-	-	-
MEXICO	10	15	15	20	20	-	-	-	-	-	-
PHILIPPINES	10	12	-	-	-	-	-	-	-	-	-
PUERTO RICO	10	15	15	20	20	-	-	-	-	-	-
SOUTH AFRICA	20	20	-	-	-	-	-	-	-	-	-
U.S.S.R.	-	-	-	-	-	-	-	-	-	-	-
EAST COAST	10	15	20	20	20	-	-	-	-	-	-

*Try new higher band!

(1) District 10

NOVEMBER 1993

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G	2 G-F	3 F	4 F	5 F	6 F
7 F-G	8 G	9 G	10 G-F	11 F-G	12 G	13 G
14 G	15 G-F	16 F-P	17 P	18 VP	19 P-F	20 F-
21 P	22 VP	23 P	24 P-F	25 F	26 F-G	27 G
28 G-F	29 F	30 F-G				

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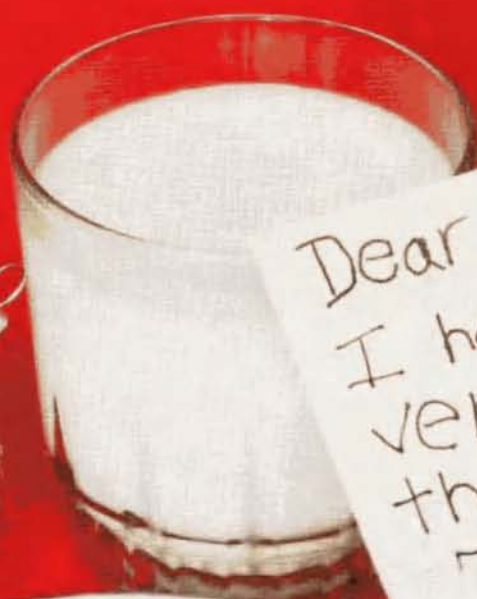
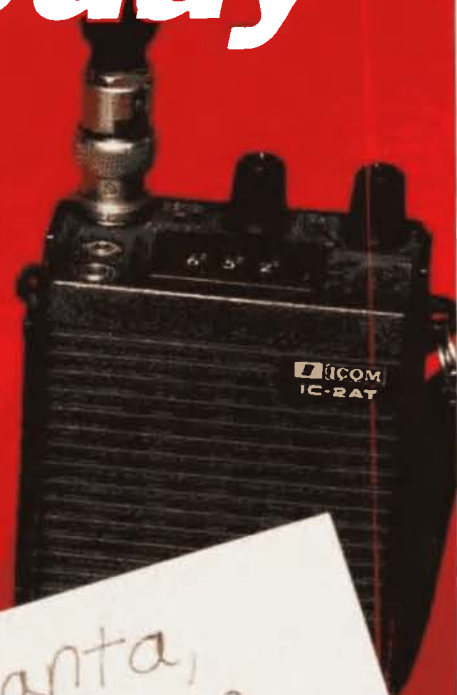
Building Better Breadboards

Remote Tuned Antenna

73 Reviews

Midland HT

The HANDI-Finder



Dear Santa,
I have been
very good
this year
73,
Wayne
P.S. I will be
listening for you
on 146.52



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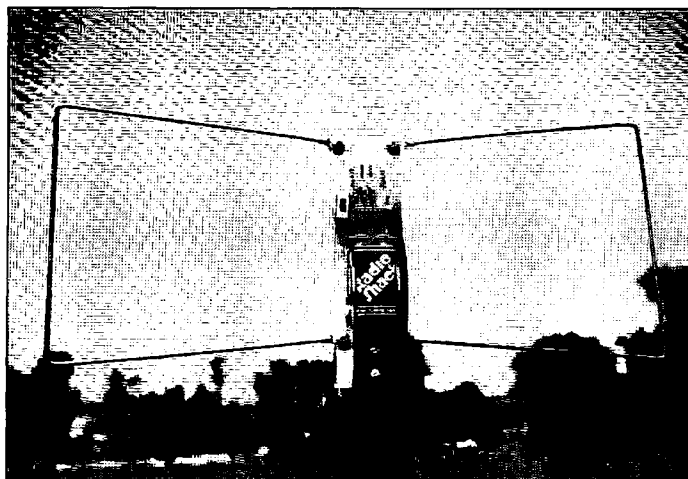
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On the cover: A recently-discovered photo from the Green family archives.

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NEVER SAY DIE

Wayne Green W2NSD/1



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. . . than making it. That's the hard part . . . at least for most of us. So wouldn't you like all the guidance you can get to help you spend your money wisely? I really hate it when I get suckered, don't you? Well, you can help me and the rest of us who might blunder into some sucker bets by giving us the benefit of your experience . . . happy or sorry.

Here's the drill. Whenever you buy any ham product . . . a transceiver, HT, antenna, book, gadget, and so on, check it out carefully and then let me know how much you'd recommend it, on a scale of one to 10, as something you think the rest of us ought to buy. Give me your call, your recommendation, your age, and how long you've been a ham. You might send it on a QSL card, a page torn from your old spiral notebook, via the 73 BBS, CompuServe, MCI, fax, or whatever. No, never mind the whatever.

If you've bought one of the ARRL books, how is it? How about the new CQ videotapes? I was surprised at how good they are. What do you think? I'm still trying to decide what rig to get for my new ham shack and so far you haven't been a lot of help. Look, I tell you when I find things I enjoy and think are a good deal, so what's wrong with you reciprocating? I might even pass your rating along to help other readers get the most from their money.

One to 10, with one being absolute garbage . . . like a certain KV4 I could name . . . and 10 being heavenly bliss . . . like my Scott Kirby CDs of Joplin's music. By the way, 99% of you have disappointed me far beyond my ability to express myself . . . and you have to admit I'm pretty good at that . . . by not yet buying one of Kirby's Joplin CDs. I've thought it over carefully and decided that Scott Joplin was the most creative composer America has ever produced. Yes, he was black. What are you, a bigot? This came to mind because Volume 4 of "The Complete Joplin" is now available. This is the last of the series.

Just as I try to get you to enjoy all the different things we can do in amateur radio . . . things that I've enjoyed

. . . I've been trying to get the readers of my *Secret Guide To Music* to try the music that I love the most. And I've been succeeding pretty well. I've gotten thousands of my readers into Joplin's incredible music, and even converted thousands of rock fans to enjoying classical music, too. Do you have a CD player yet? There must be some music you enjoy listening to. So get a player and take a little time to sit back and luxuriate in music that will help rebuild your psyche. Then try one of my Joplin CDs and see what happens to you.

I'm sure I've told you the story, but you've probably forgotten it. What happened was that when I saw *The Sting* around 20 years ago I loved the music and started buying every Joplin LP I could find. But the more I listened to them, the more I knew something was missing. They all sounded too much like a player piano. I wished my father hadn't been so against my learning to play the piano when I was young. I wanted to let the beauty I could sense in the music come out.

When I got into the music business publishing *CD Review* I started bugging the record companies to look for a pianist who played Joplin right. I got nowhere. They just looked at me funny. So late one night I was walking along a street in New Orleans, coming back from a riverboat jazz concert, when I passed a grungy little bar with piano music coming out the door. Joplin! I grabbed Sherry and stopped. Hey! We went in, sat down and had a couple Cokes. There was this young kid with a ponytail playing Joplin the way I'd heard it in my heart. After a couple hours of ecstasy I knew I was in the record business. Yes, I knew that 95% of all records lose money. I didn't care. People just had to hear this. It was a mission.

So we bought Scott Kirby to New Hampshire and recorded a CD of Joplin's music. Sherry found a nice old Steinway piano in the Peterborough Unitarian church, and by luck I had an experienced recording engineer working for me. We got Knud Keller KV4GG, who had been my bookkeeper for years, to keep the old piano in tune. Knud used to be a concert pianist in Stuttgart before getting practical. I paid him off with a new ICOM rig.

Kirby, 24, was an Ohio State graduate, with a good solid classical music background. But he loved Joplin's music so much he moved to New Orleans from Columbus, bought a piano, put wheels on it, and played Joplin's music every day on the streets. As far as I know, Scott is the only person in the world making a steady living playing ragtime. There are one or two chaps playing ragtime in the Disney parks, but they're part-time. Kirby turned out to be one of the nicest guys. Despite his stupendous talent, he's unassuming.

The church was a difficult place to record. Every time a truck went past on Route 202 Scott had to stop and start over again. He and David Torrey, the engineer, got to recording after midnight to avoid these interruptions. So when we wanted to do a second CD we had Knud look for a better piano, one we could set up in the garage at my farm, using that as a studio. Knud found a wonderful 1898 Steinway upright. Great sound. Then he found an 1896 Bradbury upright concert grand, which was even better for some of the rags. The Steinway was great for the concert pieces. David set up sounding boards to liven up the garage and Scott did another CD. He liked the new pianos so well we decided to start this new CD as Volume 1 of a set of four CDs of the "Complete Joplin" rags, marches and waltzes.

About this time Phil Martus, from the circulation department, got to helping clean out my barn. He did a marvelous job. I looked at the huge space he'd cleared and thought we had room to build a recording studio. David designed it and Phil, with his brother Greg, built it. The end result was something you ought to see if you ever get up this way. It's state-of-the-art digital. Artists who've come here from all over the world to record tell me it's the finest studio in the country. Scott did Volumes 2, 3, and 4 in the new studio.

Now that he's done all of Joplin's music he'll be coming up to record some good rags by other composers. But most of all I want you to hear the wonderful rags that Scott's written.

Since appearing on my Greener Pastures Records, Scott has been invited to play at the major ragtime festivals around the country. He's knocked

'em dead! When he finishes playing there's a silence and then the audience gives him a standing ovation. No one else gets that, and there are some famous ragtime performers at these shindigs. If I get you hooked on ragtime, which I hope I can, you may be getting together with me at festivals in Sedalia in June, Boulder in July, and Fresno in November.

I hope you'll excuse me for coming on like this, but since most of you have been reading my stuff for years, I think of you as friends I write to every month, not as subscribers. So I share my enthusiasms and frustrations with you. I haven't told you, but when you take the time to write back, I enjoy reading what you've got to say. I try to answer, when I can, but I can't answer everyone. In my music magazine I ask my readers to let me know if they find a CD which they think I'll enjoy . . . and I do the same for them.

So that's why I'm after you to try your hand at 10 GHz, where I had so much fun making contacts with Chuck Martin WA1KPS in seven different states. That was so exciting I didn't want you to miss out. Ditto if you can make it on a DXpedition somewhere. These are things you'll remember the rest of your life with pleasure.

That's one thing I like about music . . . once you get a record you'll always be able to enjoy it. Don't get me started! I feel the same way about books. Hey, you really ought to read this one! Well, I can't get you into my living room and play my favorite CDs for you or walk you through my library, pointing out the books that are the most fabulous. I can't even get out my slides and show you how exciting it was to visit and operate from Sabah or New Caledonia. But maybe I can get you to try your hand at some satellite contacts. And how about getting geared up for some 2m aurora contacts this fall? I guarantee you'll never forget one single contact! And if I can get you to subscribe to my music magazine, we can share our music tastes. I'll try to get you tuned into Delius, Gliere, Ippolitov-Ivanov, and a few more. But my first try will be Joplin. Maybe I'll get you to buy the boxed set of four CDs for \$60. Probably not. But you should.

I bought my first record when I was around 12. Strauss waltzes. RCA Red Seal. Cost a buck for 10 minutes of music. That's around \$20 in today's dollarettes. Now you can buy a superb 60 minutes of music for around \$15. I've been putting out samplers for \$3.79, just to cover the postage and handling, each with an hour of wonderful music. I've over a hundred of 'em available. They're all listed in my *Secret Guide*. Each has about 15 of the best-rated tracks from recently released independent record company CDs. This is one of the best ways to shop for new CDs. There's nothing like hearing the music to know whether you're going to want to invest \$15 in a CD.

Oh, I forgot. I got all wrapped up in

Continued on page 80

From the Hamshack

William W. McConnell KD4UUB, Clover SC I live in a region where thunderstorms are frequent, sudden, and severe. I'm concerned about providing adequate lightning protection for my ham shack; however, I find that the ham literature on the subject is superficial and not very helpful.

I sent for and received the catalog from Poly Phaser Corporation, a 73 advertiser, and was delighted to find it contains lots of good information about lightning protection/grounding systems and about their products. But their information is aimed primarily at large commercial installations which are, undoubtedly, the source of most of their business.

My suggestion is that 73 commission an expert in the protection/grounding field to prepare a comprehensive article (or series) on this vital subject. I envision that the article(s) would cover the current technology and would be written specifically to cover a typical ham station.

Perhaps 73 would publish this up-to-date information on protection/grounding systems that will be definitive for ham applications.

Bill—Coincidentally, the September issue of Radio Fun features an article on the fundamentals of lightning, including dos and don'ts for the average ham and a book review for those seeking more information. This may not answer all of your questions, because lightning is still not completely understood, but I hope it helps you . . . Charlie WA1RZV.

Harvey A. Nelson N9FHO, Madison WI Wayne—OK, here's the check for my renewal.

I usually agree with most of what you have to say regarding our hobby. One instance where I disagree with you (and most of the amateur community) is on the 14.313 MHz issue. You tend to view things from the perspective of an entrepreneur (you're a good one!) . . . cost/benefit ratios, market analysis, perceived value, image, product development, etc. I work in a hospital (I'm not an MD) and tend to view issues in terms of treatable/non-treatable disease.

Suppose that your community was experiencing some sort of infectious epidemic. Suppose that doctors and public health officials tell you that there is no cure for the disease but that it can be localized and contained in a very limited area . . . say a little island in the middle of a river that runs through your town. Would you be willing to sacrifice that little island for the good of the greater community? Are you willing to accept a leper colony in your midst?

My answer, in this instance, is an emphatic YES! What we have on 14.313 MHz is a spot where a good

portion of the "crazies" have decided to collect themselves. Without prodding from the rest of us, they have found their fellows and are busily feeding on one another. That leaves the rest of the band open for our more pleasurable activities. There should be one such frequency on every band. We can avoid being "infected" by using our receivers properly . . . a trick I learned in my old TV-watching days: The big knob changes the channel and one of the little knobs usually turns it off. (We might include this bit of knowledge in the Extra Class question pool!)

You and I, in laissez-faire fashion, need not concern ourselves with what others choose to listen to, but with making our own conversation interesting enough to attract our own following . . . hoping that our insightful questioning will add to our own stores of knowledge.

But what about the youngsters? The 12- and 14-year-olds we hope to attract? Don't we have some responsibility for them? We must protect their tender ears, if not their minds . . . right?

Baloney! Those 12- and 14-year-olds, each and every one, has at least a parent who has taken on that responsibility . . . if not willingly, then by force of law. Our obligation in their nurturing is to pay our taxes to provide for their schools and to avoid hitting them with our automobiles when their parents allow them to play in the streets! Nothing more.

The parent must play as much a part in the kid's newfound hobby as the kid. The parent has the responsibility for knowing what is happening on 14.313 and monitoring his/her child's activities . . . the same responsibility they have for monitoring what books and magazines the kid reads and what movies and TV programs the kid watches (hopefully not many!). When the kid blunders onto the frequency, the parent will have to explain what the "cancer" is all about and how to cope with it.

You might want to provide parents with the insights they will need (as a part of your business venture). How about sending a nice letter/pamphlet to the parents of the newly licensed young ham, explaining some of the more unattractive aspects of our hobby, along with complimentary copies of your rags? After all, mom and dad are most likely paying for the kid's magazine subscriptions.

For my own part, I will encourage youngsters to begin their ham careers in digital modes . . . there ain't no backspace key on a tongue or microphone.

The only problem with that, Harv, is to figure out how we can keep the

FCC Commissioners from hearing the baloney on 313, and thinking that we're all like that . . . Wayne.

Fred Carmichael KD4ATW, Chattanooga TN Reading Wayne Green's "Never Say Die" columns in August and September, and David Cassidy's "Random Output," has encouraged me to voice my opinion of the No-Code Tech license and the license procedure.

I am 47 years old and ever since I was 12 years old I wanted to be an amateur radio operator. I took the test the first time when I was 12 years old, and have taken it four times since. Each time I failed because of not being able to receive the code. However, two-and-a-half years ago I passed the No-Code Tech. I have had a great time since, operating 2 meters, 70 cm, and packet. I enjoy packet the most because it involves three of my loves: amateur radio, computing, and bulletin board systems. If it weren't for the No-Code Tech, I would not be writing this letter. I am currently working towards my General, but once I pass I will only use the voice bands, not CW.

We need young people in our ranks of amateurs. Young people are not interested in learning code, but most are interested in computers and other digital modes.

I agree with both Wayne and David in that we need to change the license structure and testing requirements if amateur radio is to survive. I suggest that we have two classes of licenses. The first would be for 10 meters and below; the second for all above 10 meters. We could call the first class "Amateur" and the second "Amateur Extra." To take care of all the old folks who like relics (code), we could do like the present system: Tech and Tech Plus. Next we would need to change the test to cover the FCC rules: operating practices, and how to properly use your radio equipment. The code side of the test would be optional, with 5 wpm for Amateur Plus and 13 wpm for Amateur Extra Plus. This way, if you wanted to use the relic, you could take the optional code test to get you Plus. Code would not be a requirement.

I have read articles and heard everyone talking about amateurs needing to change, getting younger people involved, and moving into the 21st century and not clinging to the past. I also know that making the changes I have suggested would require some changes internationally, but why not make these changes?

Peter A. Bergman NØBLX, Brainerd MN Wayne—I agree completely that something is wrong with education in America. We have "Honor Students" who cannot find their town on a map and have trouble with arithmetic, forget trig or calculus.

Much of the problem comes from the fact that "fashion" sweeps through the educational establishment and, once in vogue, some of the ideas are almost impossible to dislodge. Cur-

rently, it is considered nasty to make kids memorize. This bit of nonsense has been around long enough that memory skills and the teaching of them is almost a lost art.

Another educational jewel is called "process not product." The followers of this one believe that if children are taught how to think—always an admirable goal—they will derive the facts for themselves. Rather like making bricks with straw, not clay. If you want a challenge, try teaching science out of a "P not P" textbook.

I enjoyed your thoughts on getting something for our foreign aid. Why not use the idea a little closer to home? Let's buy Haiti—if we can figure out who the government is. It would give us a place for an open market enclave close to the US, also perhaps a location for a large HIV sanitarium and save the Haitians wishing to live in the US a dangerous boat trip.

By the way, I have a college degree in education. I'm also dyslexic and have ADD. Sr. Mary Margaret didn't know about them so she just made me work harder instead of giving me an excuse for failure.

I don't teach anymore; I drive a cab for the handicapped. It's less frustrating.

Lavee Israel 5NØSVL/4X1UF, Lagos Nigeria Wayne—It's a pleasure to read your magazine after a pause of several years. I especially love to read your editorials, and I like them very much. In most cases I agree with you 100%. It is a pity, however, that people are so narrow-minded and stubborn, especially when they have to dictate to others what to do.

For the past two years, the recession in Israel has pushed me to do business in Nigeria, where I deal with commercial two-way radio, combining it with my hobby, operating as 5NØSVL. We are trying very hard to help as many youngsters as possible to join the hobby and I would like especially to mention Kunle 5NØQBA, Peete 5NØCEP and Musa 5NØSAI. If we need contributions of used radio gear, Peete tries to help us. If it's for VHF repeaters, we keep trying, sometimes in a hostile environment . . . but usually we are able to accomplish the goal. Your editorial from August is encouraging because it points out that we need to bring in as many young people as possible because this is the future, and not only in Nigeria. It applies to Jordan as well as to Israel, too, since that government is making the same mistakes. Maybe the only one doing it the right way is Japan, as you mentioned.

There are many club stations in Nigeria, and we have a weekly net every Sunday morning at 0800 on 7065 kHz. What we are trying to do is find as many surplus SSB radios as possible so those clubs can operate on this frequency.

It is very good to read your excellent magazine again. Keep up the good word and keep saying the right things.

Government Launches PCS Era

The Federal Communications Commission has allocated 160 MHz for the new PCS (Personal Communications Service) in the 2 GHz band. The decision is expected to spark intense competition to deliver wireless services.

The FCC plans to use auctions to award PCS licenses. Local telephone companies are seen as the big losers in the decision. The new PCS service will compete with the cellular telephone industry and will carry data, video, and voice transmissions.

What this will mean to the future of ham radio is anyone's guess. Some are already speculating that PCS will be to the 1990s what the cell-phone was to the 1980s. One lightweight portable communicator could soon serve you at home, at work, and in your car. Your phone number would follow you wherever you go. The system can deliver reliable communications to portable phones, FAX machines, and pocket computers.

The Clinton Administration hopes to generate as much as \$10 billion for the treasury from frequency auctions. By the year 2010, 60 million subscribers could generate up to \$40 billion in revenue. *TNX Electronic Engineering Times, Issue 765, Sept. 27, 1993, and W5YI Report, Issue 19, October 1, 1993.*

ICOM Is Dealing

ICOM America is for the first time offering discount coupons for a variety of products that complement ICOM radios. Anyone purchasing a new ICOM radio between now and December 31, 1993, will receive a book of 32 coupons from 21 leading manufacturers who sell products and accessories.

ICOM's Chris Lougee says, "Virtually every time someone buys a new radio, they need additional components to go with that radio. ICOM is taking a leadership position in identifying complementary products and making arrangements to sell those products to consumers at a significant discount. We believe it will broaden the appeal of amateur radio."

High-Tech Highway

The Clinton Administration's Information Superhighway Plan is starting to take shape. The NTIA (National Telecommunications and Information Administration) will be given the lead role in its formation. The government's strategy calls for competing multiple cable, telephone, and computer networks.

Commerce Secretary Ron Brown will steer an industrial advisory council. You can expect major modifications to existing cable legislation and telephone restrictions. *TNX W5YI Report, Issue 19, October 1, 1993.*

Confirmation Likely

Communications attorney Reed Hundt is expected to be confirmed as the new FCC Chairman. Hundt was well received in his initial confirmation hearing before the Senate Commerce, Science and Transportation Committee.

The 45-year-old Hundt is a partner in the

Washington law firm of Latham & Watkins, and he enjoys the friendship of Vice President Al Gore. Hundt has supported increased competition in the telcom industry and universal access to new information technologies overseen by the FCC. *TNX Electronic Engineering Times, September 27, 1993.*

Canada Loves Its Hams

A seven-page full-color spread titled "Loud and Clear" graced the pages of *Canadian Geographic* magazine's September/October issue. The feature article paints a sparkling picture of amateur radio operation in the Dominion.

The story was written by Janice Hamilton VE2JHJ and photographed by husband Harold Rosenberg VE2HRP. Rosenberg says, "I feel that spreading the good word about ham radio is very important, especially in the mainstream press." *TNX ES FB VE2HRP, VE2JHJ, and The Royal Canadian Geographical Society.*

Technical Opportunities Knock

There will soon be far fewer opportunities for blue-collar workers, and a lot more for those who possess technical expertise, according to an expert quoted in *Electronic Engineering Times*. Dennis A. Swyt, a technical manager at the Institute of Standards Technology, painted a picture of an America where engineers and skilled technicians will gain influence and power.

Swyt delivered his remarks to the Engineering Workforce Commission. He added, "The most important occupation group in the U.S. today, and continuing in your lifetime and your children's lifetime, is that of the technical professionals." *TNX Electronic Engineering Times, Issue 767, October 11, 1993.*

RF Standards Could Impact Hams

New RF safety guidelines proposed by the FCC could have an impact on the Amateur Radio Service. The standards being considered (at press time) are the same as those already adopted by the IEEE and the American National Standards Institute.

Possible ramifications for hams include new questions in the licensing test pool, tougher regulation of RF radiation in new products, and a heightened awareness of possible hazards from exposure to RF. *TNX W5YI Report, Issue 19, October 1, 1993.*

Making Copies

The FCC has published a "Policy on the Private Printing of FCC Forms." Under the Commission's rules, blank forms may be reproduced by private companies at their own expense, provided:

- The form must be comparable in quality to the original document without change to page size, image size, configuration of pages, folds or perforations, and matching as closely as possible the paper weight, paper color, and ink color.
- Reference to the U.S. Government Printing Office must be deleted. Except as above, do not

delete from or add to any part of the form, or attach anything to it.

- Do not add any special personalized symbols, words, phrases, or advertising.
- Be sure the current version of the form is being duplicated.

TNX W5YI Report, Issue 19, October 1, 1993.

Hams Fight Arson

Ham operators in Oakland, California, are patrolling the East Bay hills in an effort to stop a recent rash of arson fires. Four volunteer hams are on the lookout team working in cooperation with local fire authorities.

Officials hope the additional presence will help to curb the purposely-set fires. The latest list of arson cases has reminded residents of the fire storm that killed 25 people in the bay area back in 1991. *TNX Oakland Repeater Association, Oakland Tribune, and Westlink Report, No. 658, September 30, 1993.*

Mega-Micro QSO

Paul Lieb KH6HME and Chip Angle N6CA recently set a new 902 MHz terrestrial distance record of 2,469 miles (3,973 km). The CW contact, with signals just out of the noise, came at 0136 UTC on August 23.

For the next four hours, the pair tried unsuccessfully to make contact on 2304 MHz. A frequency near 144 MHz was used for the liaison. The equipment used for this historic achievement was designed by N6CA. *TNX Westlink Report, No. 658, September 30, 1993.*

Gert Alert

The Miami-based Sociedad Internacional de Radio Aficionados (SIRA) activated its emergency 20 meter net during hurricane Gert, while 100 mph winds slammed into the Atlantic coast of Central America on September 15. Net control station operator Rafael Estevez WB4ESB handled relief communications with many amateur stations as 65,000 people were evacuated along the Costa Rican and Nicaraguan coastlines. Weather bulletins issued by the National Hurricane Center in Coral Gables, Florida, were also transmitted to Central America, after being translated into Spanish. *TNX W5YI Report, Issue 19, October 1, 1993.*

Rules Change: No Big Deal

So far the consensus is there has been no significant change in amateur radio activity in the wake of the FCC's recent "Relaxing Restrictions on the Scope of Permissible Communications in the Amateur Service." The new Part 97 rules went into effect on September 13, permitting limited business communications on the ham bands.

Under the relaxed rules, hams can now make appointments, give weather report information to the National Weather Service, and order food. Fears that the VHF bands would become a pizza ordering service so far appear half-baked. *TNX W5YI Report, Issue 19, October 1, 1993.*

Deluxe Communications Audio Board

Enhance your audio with this practical add-on.

by David Curry WD4PLI

Have you ever wanted to improve the audio quality of your old receiver? Would you like to add technical improvements to a modern receiver? Though state-of-the-art ham transceivers and communication receivers have improved audio design, there are many benefits to building your own auxiliary audio section and implementing it to your receiver. Or, for the truly ambitious, use it as part of your own home-brew communications receiver.

The strategy here is to simply add several audio processes in series to achieve an improved audio output signal. My desire to design something like this was purely selfish. I wanted my long-wave receiver (a Watkins Johnson R-1401) to have some bells and whistles like my Kenwood TS-430S. I'm also in the process of building my own receiver for LF, and I wanted a good audio section to follow the RF section. This audio board will do both nicely.

The first section of the audio stages is an adjustable bandpass filter, providing control of either the frequency or the bandwidth without changing the volume or other parameters. The original bandpass filter circuit appeared in the December 1992 issue of *RF Design*, in an article written by Jefferson Hall and Alvin Connelly. It was an excellent article and I quickly built the circuit, much to my satisfaction. After a short time, however, it was apparent that more circuitry was needed to eliminate a carrier that was within the passband, so I added a simple notch filter. This very effective design was by Randy Seden WD6ELU. The combination of a notch filter and variable bandpass filter can improve receiving conditions, but for weaker signals more circuitry is required.

An additional circuit that adds this improvement, especially for CW, is a regenerative audio stage with adjustable frequency and "Q." This type of circuit has been virtually left behind in modern radio equipment,

yet it offers many advantages, considering its simplicity. One of the greatest things about a regenerative or Q-multiplier is the ability it has to reject noise and to peak the desired signal. As the regeneration is increased, the sideband noise drops, which improves your signal-to-noise ratio. The final addition to the audio board is what I call a "digitizer" circuit, which eliminates background noise for CW signals. This is nothing more than a comparator used as a variable threshold detector. The digitizer compares the audio signal to a voltage reference, and provides a square-wave or digital output. The comparator will sometimes trigger on noise that just crosses over the threshold point, so a second comparator is used as a "window," allowing the digitized CW signal

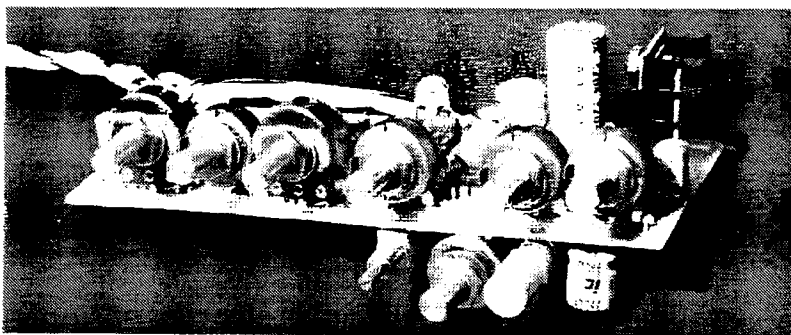


Photo A. The Deluxe Communications Audio Board.

(which is stronger) to pass, but not the weaker noise pulse. Low-pass filtering is used to clean up the square-wave signal to a more natural tone. Finally, an audio output circuit that has appeared in virtually every radio handbook was chosen for the speaker section.

I originally discovered the circuit in a SAMS book written by Walter Jung, *Audio IC Op-Amp Applications*. Low noise and low standby current are the hallmarks of this legendary circuit, using very common components. So let's review: A variable bandpass filter, followed by a variable notch filter, followed by a Q-multiplier, then a digitizer, then a 5 watt audio output section. WOW! With these devices in this particular order, it is very possible to do wonders with your receiver.

Circuit Description

The schematic shows a lot of ICs and parts, but don't let that fool you! The circuit is rather simple and can be followed easily at the top left corner, labeled "Audio Input." C1 is simply a DC blocking capacitor, while R1 sets the overall gain of the first section. If a very low audio signal is connected, R1 can be decreased in value to increase the gain. U1a, b, c, and d are all low-noise quad op amps, which keeps the size down. The filter frequency is adjusted with dual-gang potentiometer R7. The bandwidth is adjusted with R6, which controls the amount of feedback to U1a. The entire top portion of the schematic is the variable audio filter section.

The next stage is the notch filter located directly below U1. U2a and c sections provided a 180-degree phase shift of the frequency controlled by R13a and b. Using two sections of notch filtering provides a very deep null with steep skirts. Summing amplifiers U2b and d provide the nodal point where the phase-shifted frequency meets the original signal and is subtracted to almost zero. U2 is also a low-noise quad op amp. Output of the notch

section is applied to R24, which is the regeneration control for the regenerative preamp. The regenerative preamp is located by itself on the right side of the schematic. U3a and b make up a dual low-noise op amp and, as you can see, feedback is applied in desired amounts from the output of U3a to U3b and out to the U3a input again. C10, R27, C9, and R25 and 26 provide the adjustable frequency response for the filter. The potentiometer marked "Q" is adjusted once to allow smooth control of regeneration with R24. If oscillation develops, rotate R28 to the point where oscillation just ceases. The frequency control has a fairly wide frequency range to facilitate most CW signals. The audio signal is sampled at the output of U3a, and directed to switch S1. Normally, S1 is out or OFF, which applies the signal directly

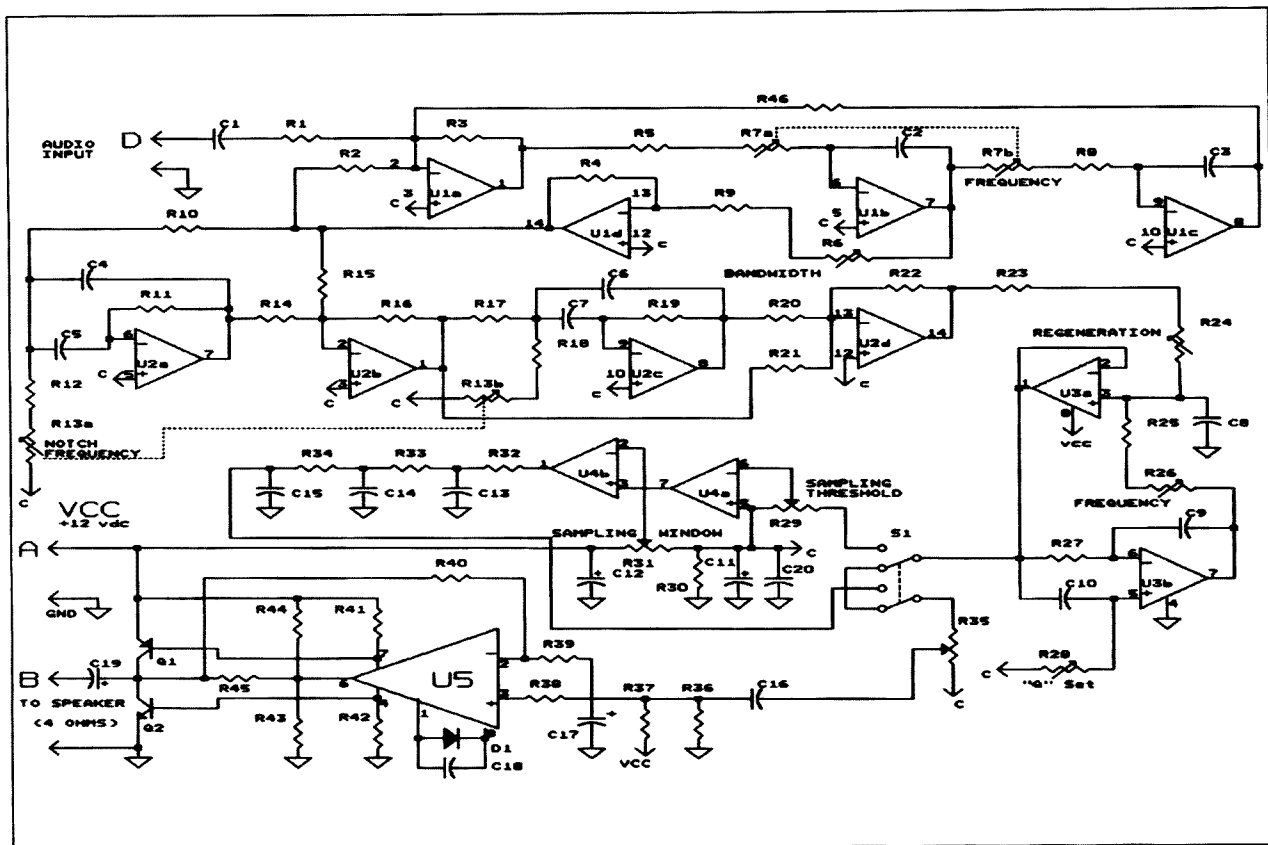


Figure 1. Schematic for the Deluxe Communications Audio Board.

to the audio amplifier stage U5. However, if the digitizer is desired, the signal is routed to comparators U4a and b. The same low-noise dual op amps are used here as with U3. Though not really intended to be used as comparators, the TI072 or LF353n op amps provide a softer comparator, making the threshold point easier to adjust. Potentiometer R29 is the input threshold control to the first comparator U4a. The signal that triggers the comparator will provide a square-wave output at U4a that is the same frequency as the input signal.

During weak signal conditions some residual noise may slightly trigger the first comparator, creating a small noise spike that is usually lower in amplitude at the output of U4a. To help eliminate this, a second comparator is used, sampling the signal that has the largest square-wave output from U4a by adjustment of R31. R31 is set to not trigger on other noise that has a lower amplitude. U4b provides us a square-wave representation of the signal to the low-pass filter. R23, R33, R34, C13, C14, and C15 comprise a low-pass filter arrangement that attenuates the high frequency components of the square wave, providing a cleaner, more listenable tone. It also lowers the square-wave amplitude to a level that can be used by the audio power amp stage. The audio power amp uses a class AB op amp to drive power transistors Q1, and Q2.

The biasing for these transistors is done

within the chip itself. This provides good audio quality at low and high volume levels since the bias is internally etched in U5. Volume is adjusted by R35. Power amp gain is set by R40. Usually there is plenty of gain to drive a common 4 or 8 ohm speaker. Diode D1 is a clamping diode to eliminate any latch-up that might occur if the speaker became shorted. C18 rolls the high frequency off just above 2.5 kHz. Resistors R43, R44, and R45 are used to set the gain and bias for Q1, and Q2. R41 and R42 are part of the biasing and power to U5.

Building Notes

The double-sided circuit board makes building this project very easy. *Remember to solder both sides of this double-sided PC board because the holes are not plated-through.* Note that potentiometers R26 and R29 are located next to switch S1 on the solder side of the board. This helps to fit more controls in a smaller space. R24 must be installed before R26. Similarly, R31 must be installed before S1, and R30 before R35. A small 5 watt heat sink is sandwiched between Q1 and Q2, and screwed securely.

Many resistors are mounted vertically on the circuit board. A small square on the layout sheet indicates this configuration. A longer rectangle denotes a horizontally-mounted resistor. Be sure to solder all pads on the component side of the circuit board that have connections to any components.

The connection points to the speaker, power supply, and audio input are marked on the layout sheet. All points marked "C" on the schematic are connected together as a common bias-point reference. There are no "C" connections to be concerned about during assembly.

Operation

Connect the speaker and the audio input cable to the appropriate points on the circuit board, then apply power. The advised minimum voltage for this circuit is 12 VDC, with up to 18 volts recommended. The higher voltage will help avoid any distortion at high volume. Turn all component-side controls counterclockwise.

Push S1 in to bypass the digitizer section.

Turn the far right hand control clockwise to a comfortable level.

The controls are in this order (from left to right on the component side): Bandpass Filter Frequency, Bandpass Filter Bandwidth, Notch Filter, Q Multiplier, Digitizer Sampling Window, Volume. Under the circuit board are: Q Multiplier Frequency, Digitizer Sampling Threshold, Digitizer Bypass Switch. Take time to experiment with these controls. The Q multiplier and digitizer controls take getting used to. Remember that with a Q multiplier you must have the frequency control at *exactly* the same frequency of the desired signal. The more regeneration you apply to the Q multiplier, the more

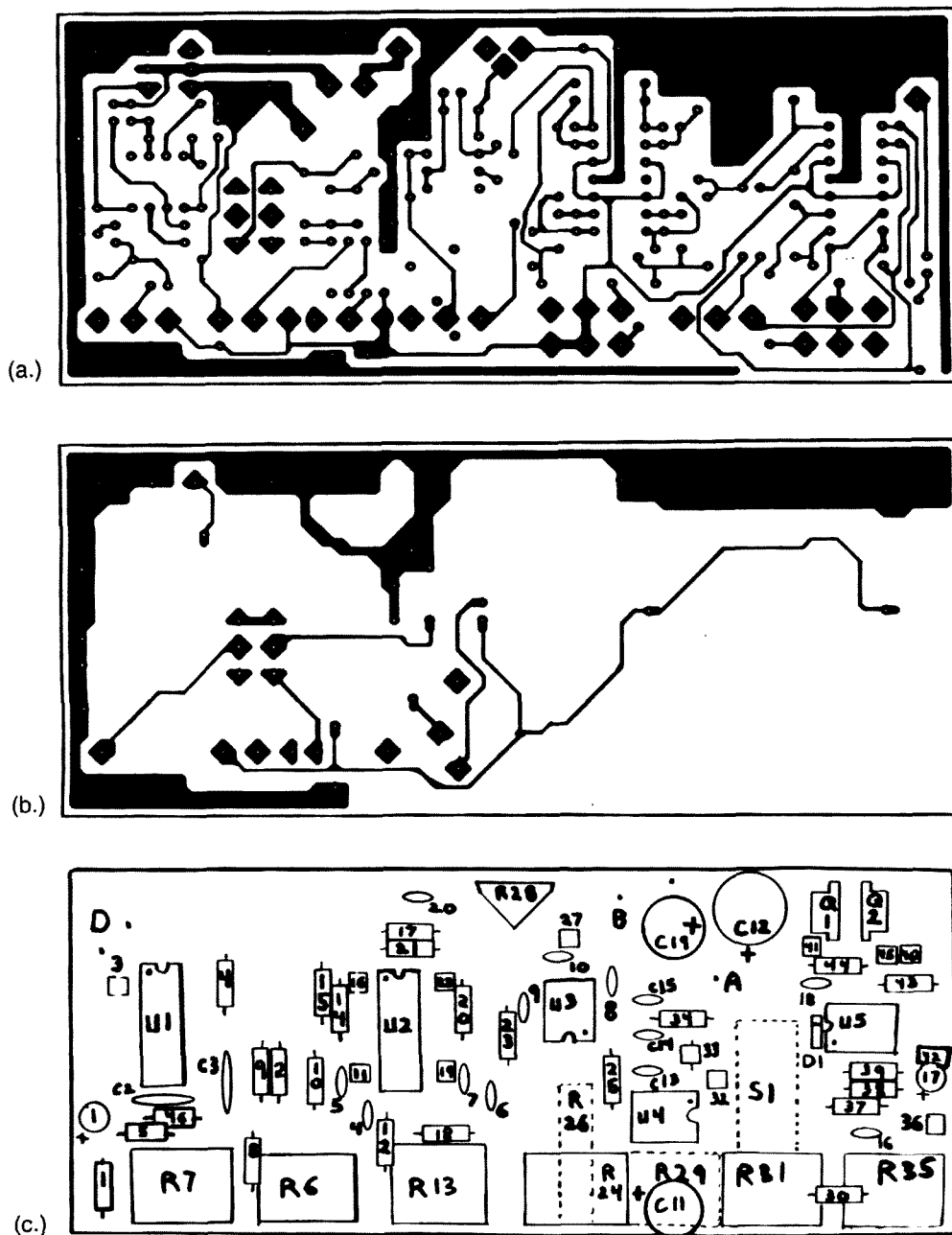


Figure 2. Double-sided PC board layout: a. Solder side; b. Component side; c. Parts placement diagram.

this requirement must be met. Another consequence of using large amounts of regeneration with the Q multiplier is that the CW signal becomes elongated, like a bubble. You can hear this effect distinctly. The digitizer can minimize this effect by triggering on the top portion of the elongated waveform, and then using the window comparator control to shore up the pulse width. Simply put, both controls can adjust the duty cycle when heavy regeneration from the Q

multiplier is needed. During regular operation, I recommend notching any undesired signal first, then apply the bandpass filter. Sometimes the Q multiplier works very well to improve SSB or voice communication, but over-driving with too much output volume from the receiver will degrade its ability to peak the desired signal.

Conclusion

This audio output section will provide

improved reception. It is perfect for an easy weekend project, or for someone who wants to "go all the way" and build a complete receiver from scratch. This design matches perfectly to an NE602 mixer or product detector. I would like to thank the authors for engineering these fine circuits, and Randy Seden for his computer design of the notch filter section.

See Parts List on page 16.

Part #	Parts List	Purchase
C1,C17	4.7 μ F electrolytic	Digi-Key
C11,C19	100 μ F/16 VDC electrolytic	Mouser: 140-XRL25V100
C12	2200 μ F/16 VDC	
C13,C14,C15,C16,C20	0.1 μ F/50 VDC disc	
C18	27 pF/50 VDC disc	Digi-Key: P4449
C2,C3	0.01 μ F/50 VDC poly.	Digi-Key: P3103
C4,C5,C6,C7,C9,C10	0.0047 μ F/50 VDC poly.	Digi-Key: P3472
C8	0.047 μ F/50 VDC poly.	Digi-Key: P3473
D1	1N914 diode	
Q1	TIP32B PNP power transistor	
Q1,Q2 H/S	5 watt heat sink	
Q2	TIP31B NPN power transistor	
R1	33k ohm resistor 1/4 watt	Digi-Key: 316KX
R10,R17	316k ohm resistor 1/4 watt, 1%	Digi-Key: 634KX
R11,R19	634k resistor 1/4 watt, 1%	Digi-Key: 274X
R12,R18	274 ohm 1/4 watt, metal film, 1%	Digi-Key: 100KX
R2,R3,R46,R14,R15,R16,R20,R21,R22	100k ohm resistor 1/4 watt, 1%	Mouser: 31CW405
R24	50k ohm potentiometer	Mouser: 594-43P104
R26	100k ohm 25-turn potentiometer	Mouser: 32RM401
R28	10k PC mount trim pot.	Mouser: 31CW401
R29,R31,R35	10k ohm potentiometer linear	
R36,R37,R40	22k ohm resistor 1/4 watt	
R38,R39,R43,R44,R45	1k ohm resistor 1/4 watt	
R4,R30	10k ohm resistor 1/4 watt	
R41,R42	470 ohm resistors 1/4 watt	
R5,R8,R25,R27,R32,R33,R34	6.8k resistors 1/4 watt, 1%	
R6	500k ohm potentiometer, linear taper	Mouser: 31CW505
R7,R13	50k ohm dual potentiometer, audio taper	Calrad: 25-397
R9,R23	4.3k ohm resistor 1/4 watt	
S1	DPDT switch PC mount	Digi-Key: EG1003-ND
S1B	Knob for S1	Digi-Key: EG1092-ND
U1,U2	TL074 low noise quad op amps	
U3,U4	TL072/LF353N op amp	
U5	LM301AN op amp	

A complete kit is available for \$76.23 ppd.; a PC board with complete instructions is available for \$22 ppd. (CA residents add sales tax) from Curry Communications, 737 North Fairview Street, Burbank, California 91505.

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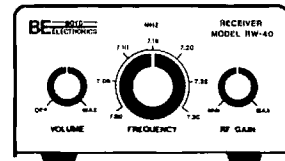
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CIRCLE 273 ON READER SERVICE CARD

Resolving 2 Meter/Cable TV Interference

A winning strategy for keeping the peace, and staying on the air!

by S.M. Yost NM8R

Is your 2m packet station in danger because of interference (TVI) it causes to the local cable TV system? Knowing your options, responsibilities, and how to track down the problem can put you back in the driver's seat. This article walks you through the entire process toward resolving this difficult issue: the technical details, how to deal with your neighbors, and how to work successfully with your cable company.

The story starts the same way, and is echoed on packet BBSs across the country: "HELP! My neighbors are up in arms, and mad as heck. I'm interfering with their cable TV. If I don't find a solution soon, my new packet station will have to go QRT. Can anyone help?"

The plea usually goes unanswered, and when it dies off the BBS, with it goes another amateur's hard-earned privilege to enjoy part of his hobby.

Worse, it's not only packet operators who can suffer. Amateur-caused cable television (CATV) interference can rear its ugly head during 2m FM voice operations as well. So, even if you're not packet-equipped (and shame on you if so!), read on . . .

KI8W BBS>NM8R (B,K,L,R,S)
S WB8HSL
MSG# TO FROM DATE TITLE
7258 WB8HSL NM8R 930907 HELP
W/2m CATV INTERFERENCE
ENTER MESSAGE/ CTRL-Z TO END

OM—Pulled the message about your CATVI problem from the Bulletin Board tonight. I understand your frustration, but hang in there; this problem can be solved! I had the same difficulty here. I fixed it, though, and I'm still on the air, with happy neighbors to boot. It takes three steps to solve this matter, so let's get started. First, you need a little background.

Long ago it was established that every radio service—commercial, government, and amateur—had its own frequency assignment. These assignments were formed into an orderly structure throughout the radio spectrum. A latecomer, however, called cable TV, added a silent partner to the plan. Silent, because cable TV's coaxial media (versus the ether used by the original ten-

ants) ingeniously allowed room for coexistence. Coax allowed two worlds, the off-air services and CATV, to occupy the same spectrum, separated by only a few mils of copper braid. One is free to roam the ether, while the other exists only within the confines of a coaxial cable. When everything works properly, one never knows the other exists.

Shielding—the basis for this coexistence—is the issue in your case. Because CATV runs a shielded, closed system, it is permitted to borrow frequencies already in use by other services. Nothing leaks out to QRM the off-the-air users, and conversely, nothing gets in to interfere with the CATV system. This may be great in theory, but how does it stand up in practice?



Photo A. Your foot survey for CATV leaks is easy and can be low profile. Who would suspect that this amateur operator (N8HGM) is sniffing out a CATV leak in her neighborhood, rather than just grooving to a tune on her Walkman? Conducting your leak survey while driving is also very effective, but don't forget to pay attention to the road!

Where the Rubber Meets the Road

Unfortunately, there are many things which can degrade a CATV system's shield integrity. When this happens, the door is opened for signals from the outside to get in, and for cable signals to get out. You didn't mention it, but I'll bet the interference is *only* on CATV channel 18, and *only* when you are on 2m. (I'll bet your HF gear, the "traditional" television interference source, isn't guilty at all this time.) Further, I'd wager it's not a harmonic or spurious output from your 2m rig. Consider this: Cable TV assignments are spread throughout the VHF and UHF spectra. They not only share the traditional TV band plan, but also many frequencies *around* it. All told, CATV signals occupy frequencies already in use by aircraft, broadcast TV, public safety services, and VHF amateur radio. Specifically, the video portion of cable channel 18 is centered at 145.25 MHz . . . get the picture?

A cable signal is very weak in relation to the signal you can accidentally inject with your 45 watt, packet-equipped 2m station. Once your signal gets in, it's not even a fair match! Plus, it doesn't take much of a CATV shield breach to let in an ample amount of renegade, 2m energy.

The Open Door

After you've pondered that for a moment, you should be wondering: "If my problem is one of getting into the cable system, why even mention their signal getting out?" The reason is simple: This is where the shared spectrum concept comes to the unexpected relief of amateurs. The shield break that is letting your 2m signal in is spraying wide-band video signals over the nearby area. The FCC takes a dim view of cable TV leakage, and for good reason. They don't want jumbo jets thrown off course by escaping "I Love Lucy" reruns! As a result, the FCC requires that cable companies check their systems for leaks, to prevent this. Also, limits are set on the amount of radiation permitted to escape from a CATV system. Lastly, the FCC requires prompt action to resolve leaks.

That covers the theory part. The second step of the three-part plan is foot patrol. Basically, what you'll be doing is scouting your

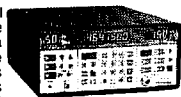
Continued on page 21



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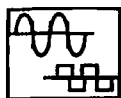
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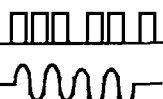
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CIRCLE 34 ON READER SERVICE CARD

Resolving 2 meter/Cable TV Interference

Continued from page 18

neighborhood with a portable FM radio, so put on your sneakers!

Recon!

Though it's the cable company's job, you can track down the leak source (they call it an "egress") yourself. But why would you want to? Don't get the wrong idea—you won't fix any leak you find. That's up to the CATV company. You'll see in a moment, though, why it's helpful to know the source of the shield breach causing the leak. For now, be satisfied that it may save you some embarrassment if the source is in your own home! Before starting, however, carefully heed the following warning: *Do not trespass on other people's property* while performing your self-styled leak survey. It's not worth a load of No. 7 shot, or a tangle with a Doberman, to find the leak! Ham radio needs your picture in the local paper because you hooked up a homesick foreign exchange student with her family or ran a battery of phone patches for weary servicemen through MARS, *not* because of an article about your arrest for trespassing! 'Nuff said!

For our purposes, you can perform a leak survey handily from the sidewalk, or from your car. Don't do it from other people's yards without their permission (and even with their permission, only with great care).

So... how do you do it?

Sniffing It Out

CATV systems inject a special modulated RF carrier into their system to act as an "odorant," sort of like the gas company does. If they have a shield break—an egress—this tone-modulated radio frequency carrier, or tracer, intentionally escapes the cable and they sniff it out with equipment carried in their vans. Luckily, you can use a portable FM broadcast band (BCB) radio to do the same! Just like your nose finds a gas leak because of the odorant injected, your portable FM radio can find a cable TV leak.

Here's how to put your amateur version of the sniffer to work. First, determine what frequency the tracer is on in your area. Do this by placing an FM BCB portable radio near your own cable TV coax. (What? No CATV in your home? Then try this test with a cooperative neighbor, or even better, the one who is complaining.) Disconnect the incoming CATV coax from the TV or VCR and, with an FM radio close by, tune until you come across a raucous whoop-whoop-whoop tone. If the carrier injector is turned on, you *can't* miss it. In my area this carrier resides around 107.8 MHz, although in some locales it's placed in the middle of the FM band. Once you know the tracer carrier's frequency, drive or walk your neighborhood, listening for this obnoxious tone. (Hook the coax you pulled for this test back up, first!)

Don't be surprised if you encounter a number of cable TV leaks in your search. Not everything you will hear, however, is a leak the cable company needs to be con-

cerned about. There *is* a permissible amount of radiation, tolerated by the FCC. You'll quickly learn to sort out the weak ones from the strong ones.

Note, too, that the sensitivity of a car's FM BCB radio is greater than the squelch setting of the commercial sniffers the CATV companies use. As a guideline, you're interested in strong leaks within a few block area of your QTH. A strong leak would be one where you hear "S9" more than 50 feet from its source. I find the car radio works best for the general search, and a portable radio for pinpointing the source.

Just remember this clue, Sherlock: Where their signal escapes, your signal enters.

What to Look For

Once your sniffer has helped you zero in on a possible leak, you need to turn to your observation skills. As you drive the system, pay particular attention to pedestal junction block housings (those 12" square by 3'-high metal boxes), and any pole-mounted distribution amplifiers. Also, scan the overhead cables for any that may have been damaged by falling branches. At a residence, the leak source can be damaged or water-corroded cable, especially in the drip loop where it enters a house. Also look for loose connectors or unterminated splitters or cable runs. Devices a subscriber puts on his line, such as cheap (poorly-shielded) coax, lengths of 300 ohm twinlead(!), and game switches, can breach the system's integrity, too. One other possibility to be aware of is the illegal tap. Take the safe path and let the cable employees "discover" these.

Why go through the hassle of hunting down the leak yourself? You don't need to. But it will help, and might even favorably impress the CATV company if you can tell them where you think the egress is located. Possibly you can even guide the CATV tech, saving him time in his search.

Contacting the Cable Company

The last step toward a solution is to make contact. (This should be easy; you're a ham, remember?!) Once you're at this point, simply pick up the telephone and call the cable company.

First, some tips to make your effort more successful:

Plan what you will say *before* calling. Your goal is to get one point across, clearly: You're the one who is causing the interference (*that* will get their attention), and you want to resolve the matter quickly, to their benefit as well as yours. Speak and act professionally—it will make a more favorable impression. Ask to speak with the System Manager, his assistant, or a member of the Engineering Department. (You may prefer to visit the cable company's office and deliver your message personally. If you're the charming, amiable type, the doors will open quickly.) After you've clearly stated your reason for contacting them, run down the following list of points to discuss: Explain

the problem and how you know the things you do. (Expect them to be curious how you know about the technical aspects of their system.) Use the word egress. (They prefer it to leak; it sounds less threatening.) Did you find anything in your own search for the egress? If so, tell them now.

Have they encountered this problem be-

fore? How did they resolve it?

Keep in mind it's not always a fault of their system that causes the leak—oops, egress. It can be devices the subscriber puts on the line. They should be as interested in these, however, as defects in their own system. Either can allow CATV signals to escape, or permit outside signal entry. It's all

in how you present it.

Don't pepper your speech with ham "Q" signals. Even though we talk this way, CATV people won't find it intelligible, or amusing.

Inquire if the cable company noted any leaks in your area at their last FCC-mandated leak survey. (They refer to this survey as

CATV Frequency Assignments

Knowing what frequency is used (and shared) by a particular CATV channel can be useful in troubleshooting CATV problems. Table 1 can help you determine CATV channel frequencies from the cable company's decoder, whether your local system uses letter or number designators. Only cable TV channels 2 through 13 correspond directly with the off-air channel frequencies. From that point, CATV channels bound across the spectrum, borrowing slices of RF real estate along the way. Although it's not shown on this chart, in some systems frequencies as low as 5 MHz are used! (Source: *Scientific Atlanta*.)

FCC Rules Governing CATV Service

Part 76 of the FCC rules is on the mind of every CATV system operator. This section governs how he operates his CATV system, and spells out the technical standards he must follow. The *FCC Bulletin* reproduced here in part (FOB Bulletin No. 17), is a checklist CATV operators can use to ensure compliance. Rules 76.601 and 76.611 are of particular interest (and help) to amateurs. Rules 76.613 and 76.614 apply in the special case of cable TV frequencies shared with aeronautical services. Keep in mind that some leakage is tolerated; you might hear leaks during your tone-sniffing survey that are entirely legal. How much radiation is tolerated? FCC rules state that, at 2m frequencies, a leaking CATV signal's strength cannot exceed 20 microvolts per meter at a distance of 10 feet. You'll probably have no way of knowing the actual field strength of any leaks you encounter. Note them all, anyway, following the guidelines given in the main article, for the benefit of the service technician. He'll be able to sort out the strong ones.

Reverse Psychology

In some areas, amateur repeaters at the low end of the 2m band have long suffered QRM from leaking CATV signals. The concepts described in this article work for tracking down these leaks and resolving them. Think of it this way: If leaking CATV signals are ruining 2m repeater operation, surely some ham in the area is getting into *their* system, too . . . Use a little reverse psychology to solve this one!

What to do if the Tracer is Off

Occasionally, lightning or equipment failure will knock a cable company's FM band tracer system out of service. If so, you'll have to resort to conducting your search with different equipment. Your 2m mobile rig and 2m HT, or a scanner, will fill the bill. (Be aware of your state's laws regarding scanners in automobiles, if you employ one for the search.) Although these methods won't be as inconspicuous as a Walkman or the FM receiver in your car, they will work. Instead of a tone, you'll be searching for the actual audio portion of a cable TV channel. Here's how: Refer to Table 1 for the audio sideband frequency of a CATV channel within the tuning range of your 2m rigs or scanner. I suggest channels A through E, as these lower frequencies carry farther once they've escaped the cable. After programming your rig, drive or walk the area listening for the audio portion of the TV channel you've targeted. Zero in on it in the same manner as described in the main article for the FM receiver. Use a scanner or your mobile 2m rig with an external antenna for the general search, and an HT for pinpointing leaks on foot.

What to do if the FM Tracer is Gone!

Depending on how progressive, or financially flush, your local cable company is, they may have upgraded their leak tracing system beyond the FM band leak tracer. The new generation of leak tracer uses specialized equipment which searches for actual video radiation on chan-

CATV Notes

nels A, B, or C. These are aeronautical frequencies, slightly above the FM band. Why the switch from a perfectly good system that was also easy for *us* to track? One incentive for the cable operator is that the new system frees FM band frequencies for commercial use. Cable systems sell an entertainment product, but no one would pay to hear a repetitive whooping tone! (Unless, of course, the customer happens to be a ham—the type who parks his receiver on WWV for hours on end . . .). If your cable system *has* made the switch, use the tracking methods described in "What to do if the Tracer is Off."

Portable TVs as Leak Detectors

It's tempting, but leave the portable TV at home; it won't work well as a CATV leak sniffer. The video component of a leaking signal weakens too quickly with distance. Beyond five feet or so of an egress, a consumer-grade TV will not detect a leak source. Also, note that only CATV channels 2 through 13 correspond directly with the frequencies of off-air TV, so it's difficult to tune the entire range of cable channels.

Neighbor PR

A little premeditated public relations effort with your neighbors goes a long way. Really now, why be hard-headed about it? Try a gentler approach. I always start with: "I'm *sorry* that I'm affecting your TV/radio/telephone . . ." It can be positively disarming, and that can work in your favor. Ditto with the cable company.

What to do when the Problem is Wrapped Up

When an RFI case of any type is finally wrapped up, I make a call to tie the ribbons on it with my neighbor. I do this to get his agreement that it is resolved, or (put the words in his mouth if necessary) "99% better, and acceptable."

Also, call the cable company and leave a message for your contact person to say thanks. Our CATV system manager went so far as to tell me to encourage other amateurs to contact him if they encountered similar problems. You can open the door for your brother and sister amateurs with this follow-up call.

Lastly, write down what you did and learned. Others can benefit from this knowledge! Share it with your local club, repeater group or packet organization.

High-Pass Filters . . . One Thing *Not* To Do

A local amateur, N8LDQ, also experienced serious CATVI shortly after my situation was resolved. Interestingly, he found that a high-pass filter, a typical TVI *solution*, was *causing* the cable system shield breach at a neighbor's home. It was a poorly-shielded L/C unit which let 2m energy in and cable energy out. Although it would have been a fine approach to an HF-related source of TVI in an off-air TVX case, in the cable system it was a Pandora's box (or gateway).

The Cable Company Field Tech and You

Try to meet the cable company technician who performs the investigation and repair work. There are two reasons to do this. First, if you impress him as a technically competent and helpful individual, you'll enhance the image of our hobby. This will help your case, and those who follow you. Secondly, you might *learn something!* (Then pass it on at your next ham club meeting!) Keep in mind the poor tech's lot: He enters the home of strangers, deals with their smoke and pets, must figure out and fix the problem, all while playing referee between the subscriber, his company and possibly even you! If you can ally the CATV company tech, your job of resolving the matter will be more effective, and quicker to succeed.

the Cumulative Leakage Index). It's not a good point to open the conversation on, but can be worked in during the visit.

Be prepared, also, for the possibility that your neighbors have not yet registered a complaint with the cable company, and you made it there first.

Once again: The basis of your position is that you are entering and QRMing the cable system because it has some type of shield integrity problem. Likewise, their signal is get-

ting out. You are licensed to transmit over the air on 2m; they are not! The problem is theirs, whether it's a subscriber's poorly-shielded jumper, or their own damaged cables. You've even helped them locate it! Both economics (lost revenue due to mad subscribers) and the FCC inspire them to return their system to a shielded, leak-free condition. Remind them of this, ever so politely. Always end with a polite "thank you," noting you are willing to assist.

Now, reread the last paragraph, pump yourself up, and go! In the unlikely event your contact attempts are rebuffed, a letter to the system manager is the next recourse. Keep copies for reference. You might need them later on. That's it, the third and final step!


In the Meantime

At all times you should be making an effort toward good public relations. If you favorably impress your neighbors with your efforts, and maybe even self-impose some quiet hours until the problem is cleared up, they'll have a better impression of you and of our hobby. (Also, in the future they might overlook the fact that your kW on 40m makes their phone chirp a bit. You can reap the benefits of this PR effort down the road, too!) You should tell your neighbors you are working with the cable company to resolve the problem. Explain as much as they want to know. Keep relations good, and try to enlist their help in your troubleshooting efforts. Besides being the right thing to do, allying yourself with your neighbors is the most prudent path to follow. You may even need their assistance at some point to pressure the

CATV company to resolve the matter.

If, after all this (and only as a last measure), no positive results are attained, write your FCC Field Office. Addresses are in the ARRL's *FCC Rule Book*. This is a last resort, though. My philosophy is that if you present yourself in a friendly, positive, and reasonable manner, you'll receive excellent response from your cable company. More often than not they will be ready to resolve the problem and will welcome your assistance. Case in point: My local cable company took less than 24 hours to solve my CATV problem once I brought it to their attention.

I also recommend you obtain a back issue of *QST*, October 1990. On page 42, two Cable TV employees, who also happen to be hams, offer some insight in the "Hints and Kinks" column. Your library can probably obtain a copy of that page through interlibrary loan, depending on their copyright agreement. Another reference well worth obtaining for your shack library is the *Interference Handbook* by William Nelson WA6FQG. It treats a wide range of interference subjects, including that of CATV, in depth.

It's late, and time for me to sign off. I'll leave you with these final thoughts: You want this resolved, and you don't want your neighbors ticked at you. They probably blame you, even though it's likely that the problem is the cable system's shortcoming, or even their own fault! Keep their viewpoint in mind though: Everything was fine until "that ham down the street" went on the air. So do things right, be helpful; but remember—you are licensed to use the airwaves. Persist! 

CATV CH	CONVTR CH	STANDARD VIDEO	AUDIO
2	2	55.25	59.75
3	3	61.25	65.75
4	4	67.25	71.75
5	5	77.25	81.75
6	6	83.25	87.75
A2	1	109.25	113.75
A1	37	115.25	119.75
A	14	121.25	125.75
B	15	127.25	131.75
C	16	133.25	137.75
D	17	139.25	143.75
E	18	145.25	149.75
F	19	151.25	155.75
G	20	157.25	161.75
H	21	163.25	167.75
I	22	169.25	173.75
7	7	175.25	179.75
8	8	181.25	185.75
9	9	187.25	191.75
10	10	193.25	197.75
11	11	199.25	203.75
12	12	205.25	209.75
13	13	211.25	215.75
J	23	217.25	221.75
K	24	223.25	227.75
L	25	229.25	233.75
M	26	235.25	239.75
N	27	241.25	245.75
O	28	247.25	251.75
P	29	253.25	257.75
Q	30	259.25	263.75
R	31	265.25	269.75
S	32	271.25	275.75
T	33	277.25	281.75
U	34	283.25	287.75
V	35	289.25	293.75
W	36	295.25	299.75
AA	38	301.25	305.75
BB	39	307.25	311.75
CC	40	313.25	317.75
DD	41	319.25	323.75
EE	42	325.25	329.75
FF	43	331.25	335.75
GG	44	337.25	341.75
HH	45	343.25	347.75
II	46	349.25	353.75
JJ	47	355.25	359.75
KK	48	361.25	365.75
LL	49	367.25	371.75
MM	50	373.25	377.75
NN	51	379.25	383.75
OO	52	385.25	389.75
PP	53	391.25	395.75
QQ	54	397.25	401.75

Table 1. Scientific-Atlanta frequency channel plan.

Part 76—Cable Television

Rule/Reference Suggested Procedure

Leakage Tests

Rule: 76.601 Conduct leakage tests once a year to show compliance with leakage standards in Rules Section 76.605. Maintain complete test data from annual tests for 5 years.
Note: Performing regular monitoring and leakage repairs in accordance with Section 76.614 will ensure that your system complies with leakage standards.

Cable Television Basic Signal Leakage Performance

Rule: 76.611 Conduct a test once a year to establish conformance with the Cumulative Leakage Index.

Interference from a Cable Television System

Rule: 76.613 Stop operation immediately and correct any condition that threatens radio navigation or other safety-of-life services.
Before reactivation, submit an interference report to the Field Operations Bureau of the Federal Communications Commission. Await response from Engineer in Charge before resuming operation.

Regular Monitoring

Rule: 76.614 Provide for a program of regular monitoring for signal leakage by checking the entire plant every 3 months when using aeronautical frequencies. Maintain a log of leakage sources, probable causes, and corrective action taken for 2 years.

Excerpt from FCC FOB Bulletin No. 17, revised edition, March 1991.

73 Review

by Dave Martin W6KOW

The HANDI-Finder

Build this versatile, accurate DFer semi kit in an evening.

North Olmstead Amateur Radio Depot
(NOARD, Inc.)
29462 Lorain Rd.
N. Olmstead OH 44070
Telephone: (216) 777-9460
Price Class, partial kit: \$27.95

Reasons for owning radio direction-finding equipment are many. DF gear can be used for locating a source of unintentional interference, documenting jamming, or for what is probably the best justification of all: The fun of T-hunting with a local group of transmitter hiders and hunters.

To get beyond the hand-held-next-to-the-body method of determining the bearing to a transmitter, some specialized gear is needed. Even at VHF and UHF, often-cumbersome DF antenna arrays are often seen connected to exotic equipment carried by serious DFers. By contrast, the HANDI-Finder DF device marketed in partial kit form by North Olmstead Amateur Radio Supply Depot is small enough to be hand-held, is easy to use, provides a sharply defined bearing, and is inexpensive. Its only apparent disadvantage is 180-degree ambiguity; if you don't know the general direction of the signal, you will have to move until the bearing changes to solve the problem of whether you are receiving the "front" or "back" of the signal.

Designed by Bob Leskovec K8DTS and based on a circuit published for use by the Coast Guard Auxiliary, the HANDI-Finder be-

comes the antenna for an ordinary hand-held radio on either FM or AM. A carrier is needed to make the system work. The HANDI-Finder works by switching at an audio rate between two antennas. In addition to hearing the signal's modulation, the operator hears a constant audio tone—until the plane of the two

"Getting into the open, however, demonstrated that the HANDI-Finder works as advertised."

antennas is perpendicular to the signal path. The tone then nulls sharply, indicating the bearing to the target transmitter, which is 90 degrees to the antenna plane. Modulation on the carrier is unaffected; only the tone nulls.

How It Works

Powered by a 9 volt radio battery, the circuit is based on a single CD4047B IC that

contains an oscillator and a flip-flop that provides complementary symmetrical square-wave outputs. Switched at an audio rate between two antennas, the switching-rate audio tone is heard unless both antennas are receiving the signal at the same time and are therefore in phase.

Building It

The North Olmstead kit includes a 1-5/8" x 6" circuit board with all of the electronic components mounted on the board. Working carefully, I finished the circuit board in 45 minutes. Not included in the kit are the antenna elements, coax and connector, handle, battery, and two 1/8" pop rivets to mount the battery holder.

For antenna elements, I used two 18" lengths of 3/32" brass welding rod. (My nearby welding supply store simply gave me two rods—enough for two sets of antennas—rather than writing up such a small order.) The vertical parts of the antennas are the receiving elements, and the distance between them can be optimized for a particular frequency band. For DF work mostly on 2 meters, I settled for a spacing of about 14 inches. After forming the U-shape elements, I soldered crimp-type wire connectors that are bolted to the circuit board.

The 13-page construction and operations manual suggests using a paint-roller handle to hold the HANDI-Finder. I chose a \$1.42 plastic model that is threaded at the bottom and fits a painter's extension pole. A vise and hacksaw came in handy. Attaching a 6-foot length of 50 ohm coax and a BNC connector completed the building project.

Using the HANDI-Finder

First experiments were near my house—too near, as it turned out. The manual notes that used indoors, too close to buildings or even large trees, multipath signals will provide multiple nulls and no clear indication of bearing. Early experience confirmed this.

Getting into the open, however, demonstrated that the HANDI-Finder works as advertised. The audio tone is apparent even on weak signals, and there's a sharp null when the antenna array is perpendicular to the bearing to the transmitter.

The final test was to talk my wife into driv-

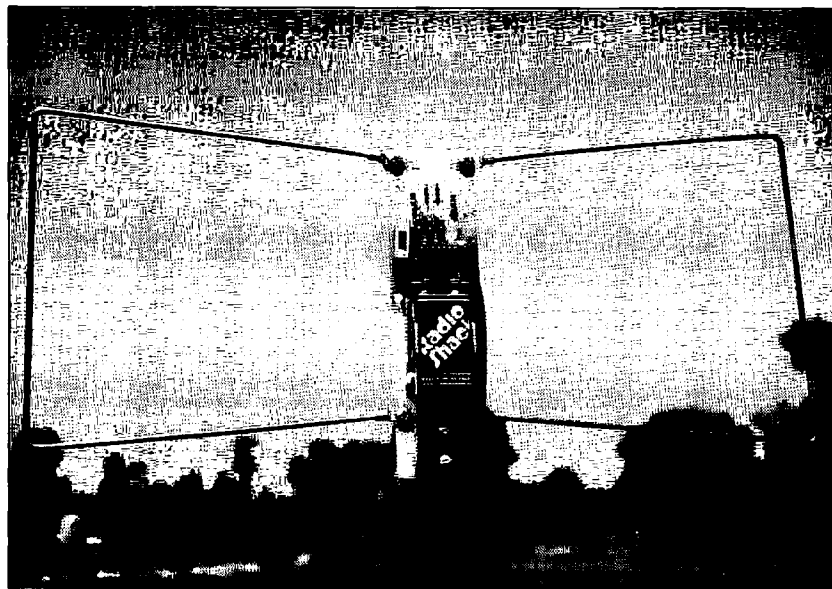


Photo A. The HANDI-Finder kit was easy to assemble in less than an hour.



Photo B. The compact, lightweight unit is powered by a 9V battery and mounted on a paint-roller handle.

ing around as I simulated a T-hunt with the HANDI-Finder on its paint pole outside the car. I cheated by knowing approximately where the transmitter was—the continuously-broadcast, low-power ATIS (automatic terminal information service) AM signal associated with the control tower at an airport about six miles from my house. This target was picked because I knew I could get quite close to the transmitter without driving to the top of a mountain.

We played the game. First we solved the ambiguity problem by driving far enough to get a consistent bearing shift. I found that "picket fencing" associated with weak signals heard while underway mobile prevented getting a distinct null; we pulled to the curb a lot. Within 20 minutes, though, we were close to the airport, and driving around it confirmed that the ATIS antenna is on top of the control tower.

The Bottom Line

The HANDI-Finder works well on any carrier-based signal that its IC can hear. By changing the antenna elements, the unit should work as low as 50 MHz and as high as 450 MHz. The circuit could also be used with a pair of directional antennas that would solve the ambiguity problem from one location—at the expense of hand-held portability.

In its simplest form, using a hand-held radio with a HANDI-Finder offers versatile, accurate, easy-to-use direction finding for about \$35. How could you beat that?

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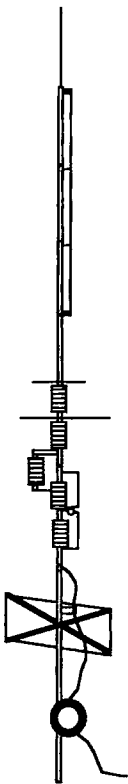
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NEW!

Model HF9V-X (shown to the left) for 80/75, 40, 30, 20, 17, 15, 12, 10 and 6 meters.

NEW!

Model CPX counterpoise kit for Butternut models HF9V-X, HF6V, and HF6V-X; substitutes for ground or elevated radials. Self-supporting tubing bolts onto base of antenna. Mast not provided.



BUTTERNUT ELECTRONICS CO.

P.O. Box 1234, Olmito, TX 78575 (210) 350-5711

Five-Element T-Match VHF Yagi

Excellent performance characteristics on 2 meters.

by Marty Gammel KAØNAN

I finally decided to get started on a long-overdue new yagi for my rooftop antenna farm, here in Minnesota. I needed a clean pattern with about 9 to 10 dB gain for FM repeater and simplex work.

I have tried several different types of antennas in the past, but I've never tried using the "T" match with a half-wave balun. So, I looked in the *ARRL Antenna Book*, 15th edition, for guidance. The balun looked easy.

Due to our harsh winters, I needed to enclose the balun, and I also needed a good solid mount for the "T" match feed point. I chose a plastic box from Radio Shack that measured 2-1/2" by 4-5/8" to house the balun. The beam itself was easy, using a 5'-long square boom from an old TV antenna as a starting point. After removing the old elements, I decided to use a close standard spacing of 13" for reflector-to-driven-element spacing. I wanted a close-spaced first

director, so I used 9" for driven-element-to-first-director spacing. For second and third directors, I used 15-1/2" and 17" spacing. The 1"-square boom was big enough for this small, 5'-long antenna. I used 3/8" diameter aluminum tubing for all the elements and the "T" match bars.

As an extra feature on this antenna, also from the *ARRL Antenna Book*, 15th edition, I added a ferrite bead choke on the quarter-wave line section of the balun. The local electronic surplus house proved to be a source for cheap ferrite beads. I also

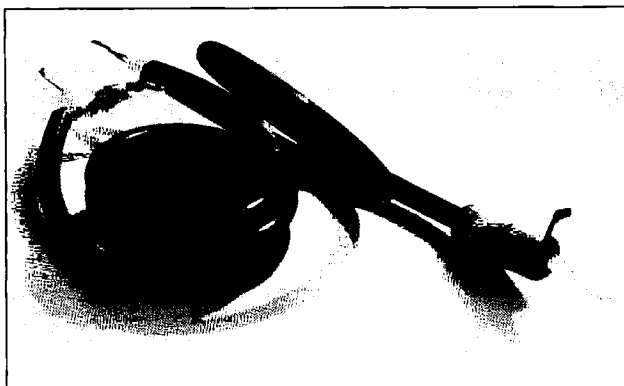


Photo A. Balun assembly, ready to install.

wound the half-wave section of coax into a four-turn choke to fit into the plastic box. The combination of the ferrite beads and the four-turn choke gives good isolation of the feedline and avoids radiation from the feedline shield. The dimensions for the "T" bars came from standard design lengths for gamma match parts. The "T" match design gives a very clean design, without skewing.

Building the Beam

Once all the old elements have been removed from the boom, mark where you need to drill to mount all five elements. I found that by mounting the elements in the center of the boom, the spacing for the "T" bar straps was more manageable. The beam will also look better. If you can use a drill press to make the element holes, they will probably be more exactly perpendicular to the boom. After the holes are drilled, try

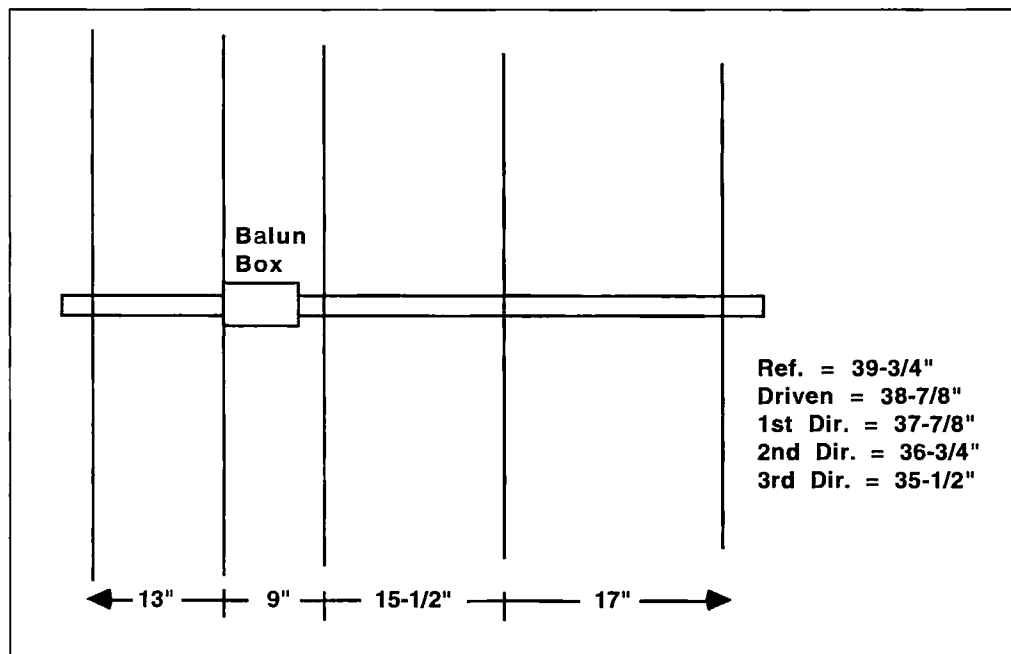


Figure 1. Five-element 2 meter beam.

fitting the 3/8" tubing in each hole and check for squareness to the boom with a square.

Cut all the elements to length, and flatten one end of each of the two 6-1/2" match bars—about 1/2" will do. Drill a 1/8" hole in the flattened area and round off the corners (see Figure 2). Attach all five elements to the boom using the 1" stainless steel screws.

Now drill holes for mounting the SO-239 and the 1" #8 bolts in the plastic box, and attach the SO-239 with three of the four bolts (see Photo B).

Assembling the Choke and Balun Assembly

Start with a piece of RG-59U about 14" long and prepare both ends as shown in Figure 2. Do the same to a 26-1/2" piece for the other balun section. Allow 3/4" on each end of both coax sections for dressing the ends. Wind the longer section of coax into a four-turn coil. Tape the coil temporarily in a couple of places, just to hold it until the finished balun is installed in the plastic box. Solder the shields from both sections of coax together (see Photo A). Install the balun assembly in the balun box; be certain all connections are correct. Install a closed-end crimp-type connector on each end of the center conductor of half-wave coax. Install the 1" #8 bolts through the crimped connectors using washers, and apply a washer and nut to the outside of the plastic box. After doing this, remove the tape from the coil. Install as many ferrite beads as you have room for on the end of the quarter-wave coax section; I had room for six ferrite beads. Solder a closed-end crimp-type connector to the shield and then connect it to the fourth mounting bolt for the SO-239 panel-mount fitting. Solder the center conductor to the center terminal of the SO-239.

Apply Crystal-Cote or some other type of sealer to everything in the balun box. Attach the "T" match bars to the balun box, and bend the ends of the metal strapping around the driven element and match bar. Then drill holes to bolt the straps to the tubing (see Photo B). You will need about 1-3/8" between the "T" bars and the driven element. Spacing for the strap should be about 4" from the center of each 1" #8 stainless steel bolt on the balun box. Fashion a mounting bracket to connect the SO-239 to the boom. It must be a metal bracket to provide the needed electrical connection between the boom and the balun. I used a piece of plumber's perforated strapping that was in my junk box, and cut it to shape with tinsnips. Mount the bracket to the boom with a sheet metal screw (see Photo B). Drill a weep hole in the lowest corner of the balun box for drainage once the box has been mounted on the boom.

Check all connections, nuts, bolts, and screws, and then mount the antenna on a non-conducting mast, ready for tuning. Tape the coax to the boom and bring the coax

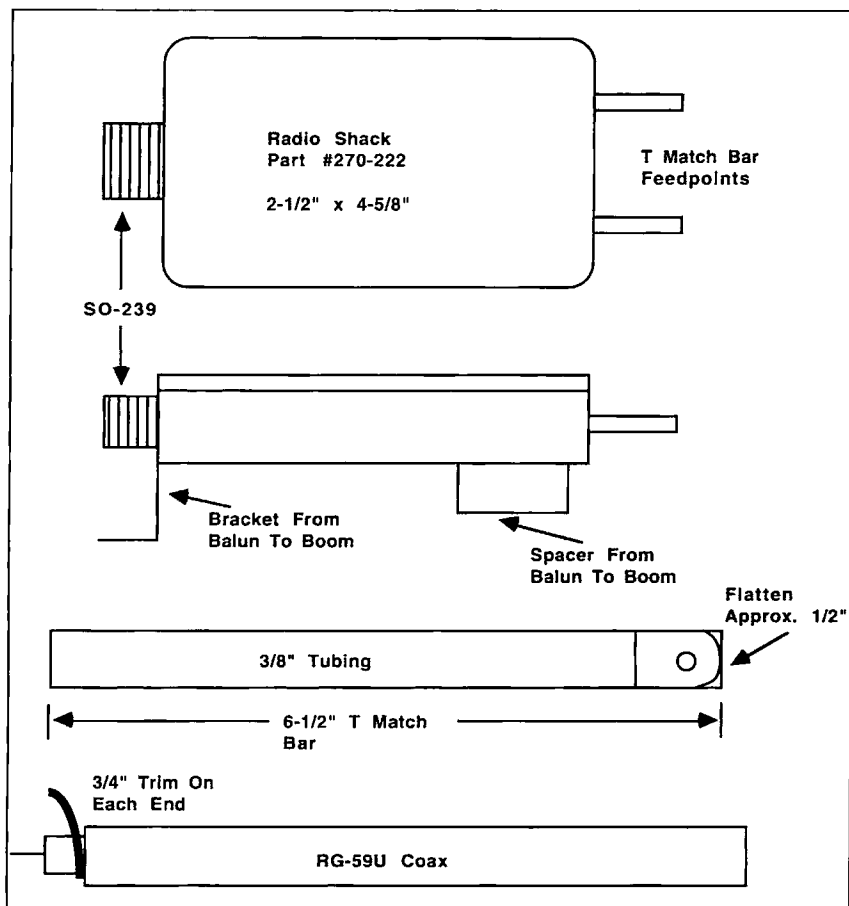


Figure 2. Balun box for 2 meter yagi.

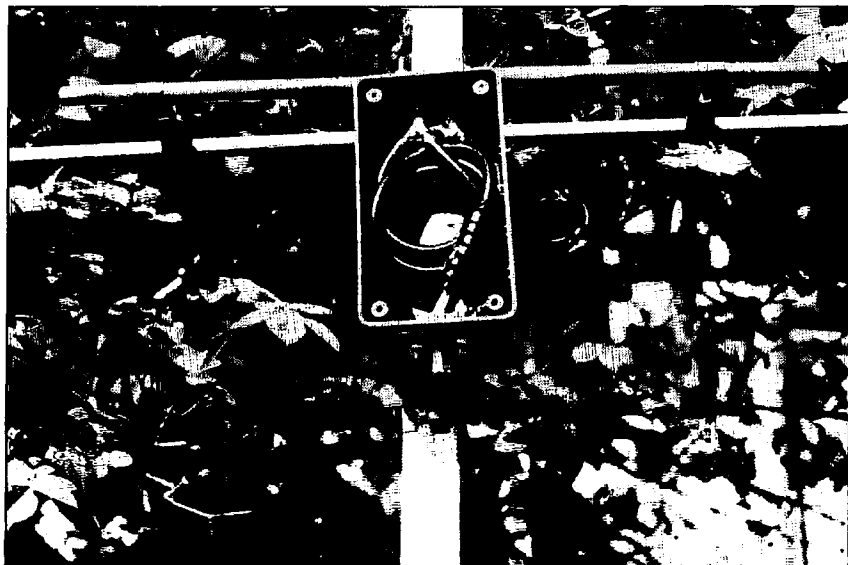


Photo B. Close-up of balun box. Note the "T" match bars and the driven element.

down the mast, away from the antenna.

Tuning the Completed Antenna

Tuning the antenna is easy. Connect the coax, SWR meter, and your radio to the antenna. Check the SWR at the top, center,

and bottom of the frequency area of design. By noting the pattern of the SWR curve you will know whether to move the match bars in or out for the best match. Move only about 1/8" at a time, rechecking the SWR curve as you go.

Mine was very close to the center of the designed-for frequency, and only had to be adjusted about 1/8" from the text. *Be sure to make all adjustments of the straps on the "T" bars equal.*

Builder's Notes

I bought the ferrite beads and the plastic box to make a clean weatherproof feed point, but all the aluminum came from my stockpile of old TV antenna parts. All hardware is common, and can be bought from any local hardware or building supply store.

"Be careful when you are cutting the coax to measure the lengths, and check the velocity factor for the coax you use."

I cut all the aluminum to length with a tubing cutter; this gives a more finished end than if you cut it with a hacksaw. Each element is installed through the center of the boom and fastened with a 1" #8 stainless steel screw (two screws are not needed for each element). Any type of non-metal spacer that you have may be used for supporting the balun box, to give the proper spacing for the "T" bar straps. I put a 1" sheet metal screw through the plastic box and spacer to hold them in place. If you cannot find an old TV boom, most local scrap metal dealers sell aluminum square and round tubing.

Be careful when you are cutting the coax to measure the lengths, and *check the velocity factor for the coax you use*. My RG-59U had a velocity factor of 66%. The number of ferrite beads is not critical, but they do stop radiation back down the coax shield. Be sure to drill or file the hole for the center of the SO-239 just big enough, but not so big that you get a sloppy fit—it does have to seal out the weather. Tune the antenna before you weatherproof and seal up the plastic balun box in case you may not have wired the connections right. Make




Photo C. Completed five-element vertical yagi.

Tools List

Electric drill
 3/8" drill bit (for holes in boom for elements)
 1/4" drill bit (for removing old elements from boom)
 3/32" drill bit (for #6 bolt holes for SO-239 mounting)
 5/32" drill bit (for #8 screw holes)
 Tinsnips
 Electrical tape
 Waterproof sealer (for balun; can be spray or brush-on)
 Plumbers' strapping or thin copper or aluminum (for balun, and "T" bar to driven element mounts)
 (Optional) drill press for drilling all holes
 (Optional) 9/16" drill bit for SO-239 to balun box center hole, or you can use a 1/2" drill bit and file as I did.
 Solder and soldering gun (for crimp type connectors inside balun)

nice neat pigtails on your coax ends so that they will be easier to attach. This design, with its close spacing, gives a very clean pattern of radiation, with at least 9 dB gain and a front-to-back ratio of 32 dB.

Many thanks to John Berglund KØUBA for his help in editing. If you have any questions, send them along, with an SASE, to me at 1703 Hewitt Ave West, St. Paul MN 55104-1128. 73 and happy hamming. 

Parts List

5'-long 1"-square aluminum boom (old TV antenna type)	6 #8 by 1" flathead self-tapping stainless steel screws (for elements)
2-1/2" by 4-5/8" plastic box (Radio Shack #270-222)	2 #8 by 1" flathead self-tapping stainless steel screws (for balun mounting)
3/4" by 1" spacer (wood, plastic, etc. for balun box mounting)	4 #6 by 3/8" flathead bolts with nuts & washers (for SO-239)
5 to 8 ferrite beads to make a ferrite choke (see text)	1 SO-239 panel mount fitting (for feedline attachment on balun box)
12.5" section of RG-59U coax (finished length) (see text)	2 1/2" by 3" metal straps (for attaching "T" match bars)
25" section of RG-59U coax (finished length) (see text)	4 #6 by 3/8" flathead stainless steel bolts with nuts & lock washers
2 pieces 3/8" by 6-1/2" aluminum tubing ("T" match bars)	3 crimp-type closed-end connectors (for coax connections inside balun)
1 piece 3/8" by 39-3/4" aluminum tubing (reflector element)	
1 piece 3/8" by 38-7/8" aluminum tubing (driven element)	
1 piece 3/8" by 37-7/8" aluminum tubing (first director)	
1 piece 3/8" by 36-3/4" aluminum tubing (second director)	
1 piece 3/8" by 35-1/2" aluminum tubing (third director)	
2 #8 by 1" flathead bolts for attaching "T" match bars to balun box	

You may have to find a few assorted bolts and washers in your junk box to complete this antenna (see text.)

Remote Tuned Active Antenna

Tune this easy amplified HF antenna without leaving your chair.

by Ken Cornell W2IMB

The March 1993 issue of *73 Amateur Radio Today* contained an article that I wrote covering an active antenna using a MOSFET. As described, it is a very broadband device. By adding a tuned input circuit, a desired frequency range coverage can be increased in sensitivity and selectivity. The problem arises as to how to tune the remote antenna from the radio shack.

The practical solution is to use a varactor, also called a tuning diode. A varactor acts as a capacitor with an adjustable value which can be changed by applying a variable positive bias voltage.

The antenna circuit is shown in Figure 1. The varactor (V) is placed across the tuned circuit (L1/C1) in series with a 0.1 μ F capacitor that acts as a voltage blocker and a bypass. The variable voltage is fed to the varactor via an RF choke.

Due to the basic design, the antenna is basically a monobander; however, the construction cost is minimal and two antennas can be fabricated from a 10' length of 1-1/2" white PVC pipe.

Varactors are not a common item found in every mail order catalog, but I have found two sources: Hosfelt Electronics, 2700 Sunset Blvd., Stuebenville OH 43592; and DC Electronics, P.O. Box 3203, Scottsdale AZ 85271. Hosfelt has a variety and I have used their Motorola type SMV16623M (catalog #MV1662/S) that comes in three matched units for \$1. DC Electronics offers a variety of sizes that include AM tuning diodes with capacity ranges at 450 pF. I have ordered some of these to try out.

The tuned circuit (L1/C1) and the varactor (V) have to be resonant through the desired amateur band. For 80 meters, I used a small 5/16" diameter by 1" long coil form and wound 50 turns of #28 enamel wire. C1 is a 5-to-6-mm 50 pF trimmer. Try 100 turns for 160 and 25 turns for 40 meters. I usually wind more turns than my target value as it is easier to remove turns than add them. A small slug tuned form would also help in zeroing in on the desired range.

I used a 1-1/4"-wide by 3-1/4"-long

piece of perf board for the circuit and mounted the parts on both sides to permit insertion in the PVC pipe. Pipe caps are used at both ends and the coax cable is fed through the bottom cap. The antenna is a piece of 1" diameter aluminum tubing 4-1/2' long. Assembly is the same as de-

scribed in my original article.

The receiver coupler is shown in Figure 2. The variable voltage output to the varactor is fed through a length of insulated hook-up wire that is taped to the coax cable. A 6-32 S.S. machine screw is mounted in the base pipe cap to accept same.

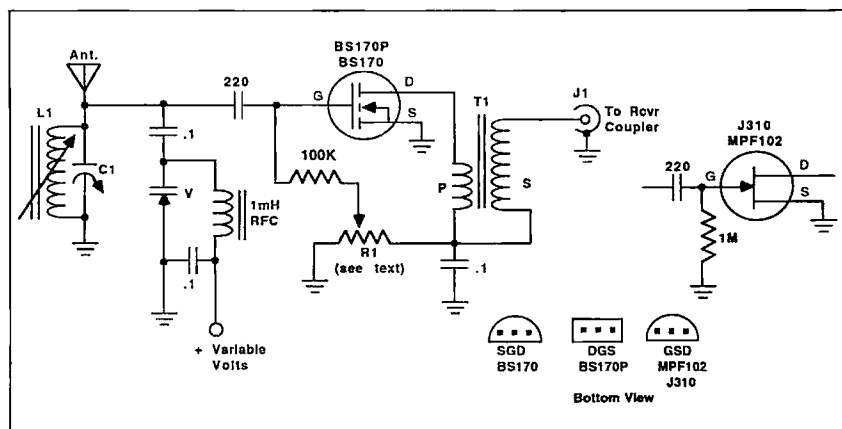


Figure 1. The remote tuned active antenna. Gate bias for the BS170 is most important for best performance. I used a 100k potentiometer for R1 and, after the proper setting was found, I measured the resistance each side of the potentiometer and replaced with same value 1/8 watt resistors.

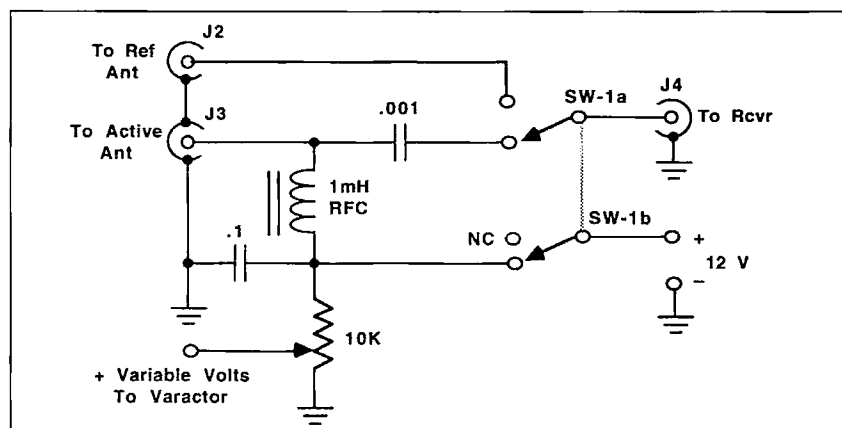


Figure 2. Receiver coupler: Except for the varactor tuning parts, all parts are as specified in my original article.

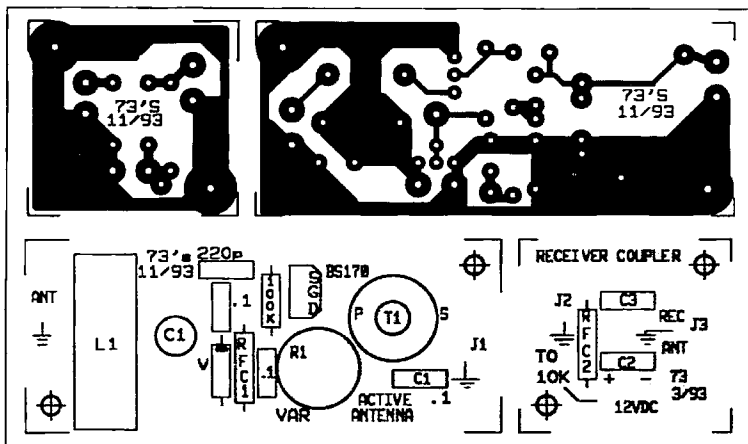


Figure 3. PC board pattern and parts placement diagram.

For the experimenter, a JFET can be substituted for the MOSFET. This minor circuit revision is shown in Figure 1a.

Parts List

- L1 To suit frequency range desired. I would suggest that you consider RF chokes for the inductance. They are cheap and come in many values to suit any frequency range desired. Consult your L/C vs. Frequency Chart (found in most handbooks).
- C1 50 pF trimmer capacitor. Used for frequency adjustment if needed.
- V Varactor. I suggest using VMAM109. It has a range of 450 pF @ 1 volt and 30 pF @ 9 volts (DC Electronics).
- Capacitors Are all disc type with 35 volt rating.
- Resistors All 1/4 or 1/8 watt carbon type.
- R1 100k potentiometer. RS #271-284 or equivalent. See text.
- R2 10k potentiometer. RS #271-1715 or equivalent. (Addition to the original receiver coupler design.)
- RFC 1 mH for HF and higher values for MF to LF. See text.
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- SW1 Your favorite coax connectors.
- J1, J2
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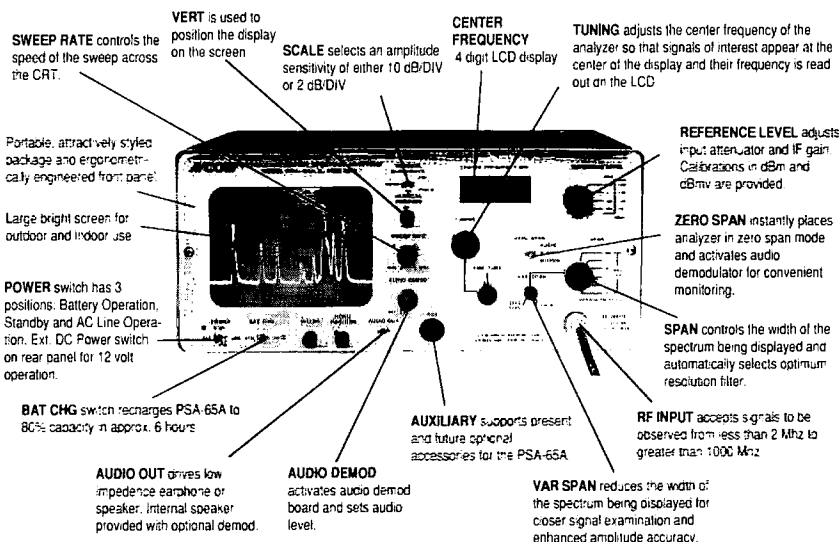
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CIRCLE 27 ON READER SERVICE CARD

by Charles Warrington WAIRZW

Midland 73-005 Transceiver

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My first 2 meter rig was a digitally synthesized Heathkit mobile which utilized lever switches to change frequencies. It was a neat little unit that took me 40 hours to build and was a dream to use. Then one night, some low-life crumb decided to steal it, along with my '67 Plymouth Belvedere. Two days later the police recovered the car—stripped, of course. No tires, no wheels, no radio! That adventure kept me off the 2 meter band for a while. It also taught me one major advantage of using an HT as a mobile rig: You CAN take it with you when you go.

Sure, you sacrifice some output power and certain conveniences with an HT, versus a dedicated mobile. But, if you live or drive in the city, you'd better have some practical method of protecting your rig from theft. The only sure-fire method that I know of is to yank the rig! Consider the HT as a possible solution. An HT can sit on the seat next to you, keep you in voice with the local repeaters, and offer versatility that a mobile can't match. Simply remove the cigar lighter plug and the BNC coax connector, and you're good to go.

Of course, this illustrates only one of the many reasons why HTs have become so pervasive in recent years. If you're thinking about buying an HT, first you have to get past the Future Shock of what's out there. There are many to choose from! One way to narrow the field would be to ask: How much does a good 2 meter portable cost? Well, how much have you got?

Money is No Object

When I first laid eyes on Midland's latest venture into the amateur radio marketplace, I thought, "Hey! Not bad for a \$400-ish HT." I immediately delved into the liquid crystal display and buttons without ever checking into the price. (Herein lies the difference between purchasing and playing with a review unit.)

Well, I kept the test rig by my side for several weeks, happy as a clam, until I noticed the Model 73-005 in a catalog, sporting a \$239 price tag. What? Midland can offer this sophisticated, surface-mount technology, microcomputer-controlled, 2 meter transceiver for less than 250 bucks? (In case you haven't shopped around, this price falls into

the "rock-bottom" range.) So, how good could it be?

First Glances

Now, you're probably thinking, "Yeah, right. For that price it's probably a real no-feature cheapie." But the 73-005 HT is no slouch. This is a nice little radio!

The actual transceiver is a tiny 5-1/2" high by 2-1/8" wide by 1-5/16" deep. (I grew up pre-Nintendo, so I still find myself in awe over the cramming of so much electronics into such a small package.) Still, the Midland is somewhat larger than the very smallest rigs that I have seen. You can attribute much of that size to the big duckie and optional high-power battery. Even so, this unit has a clean look, and is quite small enough.

The LCD panel is easy to read, and it is flat. Many HTs on the market have convex panels that are susceptible to scratches. Midland's design avoids that problem.

Tough Enough

I like to carry an HT with me whenever I go mountain biking or hiking. They are very nice to have with you in the woods and in the mountains. You can stay in touch, listen around, or just know that you could summon help in the event of an emergency. One thing you don't need on the trail, however, is a fragile piece of gear.

The new Midland is solid. Very solid. The transceiver is constructed on a die-cast aluminum chassis. It resembles a commercial transceiver, which is no surprise, considering Midland specializes in commercial gear.

This radio is also equipped with a PTT LOCK feature. This deactivates the PTT button to prevent accidental transmitting.

Design

This baby is a tad more conservative in design than many of the latest HTs. It looks more like a police portable than some of those Star-Trek-looking amateur models I've seen lately. Still, I'll give Midland good marks for ergonomics.

The VOLUME and ROTARY CHANNEL SELECTOR controls are easy to adjust without looking at them. The push-buttons on the front pad were designed for daintier digits than mine, but I can still push them one at a time—even



with my sausage fingers. These buttons are of the rectangular rubber variety. They feel like the erasers of 16 tiny new pencils.

Say, where's the squelch knob on this thing? It was cleverly "sawed off" at the factory. The owner's manual describes this as a "set and forget" type knob, and I kinda like it. It reminds me of a child-proof cap on a medicine bottle. I don't like to constantly ride the squelch, anyway—it really isn't necessary. Still, if you're a knob twiddler, you may find this feature irritating. Tough twiddling on the Midland.

On the left side of the 73-005 you will find the usual-looking rubber-covered PTT button. Just above it is the FUNCTION button, which combines with the front panel buttons to offer a wide array of features. Below the PTT is a LOCK button which mechanically holds the battery onto the transceiver.

EXTERNAL SPEAKER and MICROPHONE jacks are located on the unit's top side, next to the BNC ANTENNA jack. In between the VOLUME and CHANNEL knobs is a little red LED. This indicator lights when the unit is transmitting. The light becomes dim as the battery weakens, indicating a charge is needed.

On the right side all you will find are a carry strap loop and an EXTERNAL POWER connector. This connector, like the MICROPHONE and SPEAKER jacks up top, has a little rubber plug to help keep water and dirt from entering.

There are two more buttons on the front of the 73-005 you need to know about (aside from the touch pad, of course): the CALL and the SQUELCH/MONITOR buttons. The CALL button will generate a 1750 Hz repeater access code when depressed along with the PTT button. This BURST TONE ENCODER is unusual on rigs manufactured for the U.S. market. The 1750 Hz tone is common in Europe, but rarely used in the States. The SQUELCH/MONITOR button simply shuts the squelch circuit off while it is depressed. Push it to hear weak signals that are barely breaking through.

The LCD display indicates frequency, channel step, and special functions. These include PAG (Paging), DUAL (Dual Watch receive), APO (Automatic Power Off), DUP (semi-Duplex operation), F.L. (Frequency Lock), T.SQ (Tone Squelch), P.L. (PTT Lock protection), C.SQ (DTMF Code Squelch), S (battery Save), B (Busy scan—rather than the pause scan default mode), and + and - (repeater offsets). The LCD also displays the memory address number and memory mode. The number line style meter across the bottom functions as an S-meter on receive, and as the RF power meter on transmit.

Special Attractions

The Midland 73-005 has more functions than you can shake a stick at. Let's take a look at some of the highlights:

- Large Capacity Nickel Cadmium Battery Pack
- LCD Control Panel
- Multi-Function Scan
- 20 Memory Channels
- Repeater Offset and Reverse Switches
- Tone Squelch + (P/L)
- Dial Lamp (LCD)
- Battery Save Function/Auto Power Off
- Instant Squelch Defeat/Monitor
- Speaker/Mike and 12 Volt Input Jacks

"Probably this rig's best feature is its hot receiver section."

Note: The Tone Squelch Module is an accessory, as is the oversized (high-power) 12 volt battery pack. A 12 volt wall charger and a speaker/mike are also available.

The 73-005 comes standard with some nice features. The DTMF (Dual-Tone Multi-Frequency) encode touch pad has become a staple in the market. But not all HTs have the decode feature as well, which allows you to emulate a personal pager of sorts. The LCD screen displays the number being decoded and "beeps" when activated.

Probably this rig's best feature is its hot

receiver section. The receiver is up to (low-end) commercial specs. 60 dB adjacent channel rejection is better than most. It is a highly selective radio with a very respectable 0.16 μ V (12 dB SINAD) sensitivity as well.

The receiver has extended range capabilities. You can dial up some local police and other agencies for the heck of it. You can also hear the National Weather Service. The VCO stays locked from 135 to 170 MHz.

The transmitter will put out 5 watts with an automotive 13.8 VDC power input. The Midland is not real picky about DC power; it will run happily on anything from 5 to 15 VDC. The circuit is reverse-polarity protected.

Note that the center pin of the 12 volt input jack is negative.

The transmitter section gives you plenty of choices when it comes to output power level. The B/PT.L button selects HIGH, MIDDLE, or LOW power operation. With the optional 12 volt battery, this will give you a choice of 5, 2.5, or 0.35 watts output. With the standard 7.2 volt battery you can select from either 2 watts out on HIGH or MIDDLE or 0.35 watts out on LOW power.

Semi-duplex operation is available by using two different memory frequencies. The 2/DUP button along with the FUNCTION button will get you into DUPlex mode. You can also swap the transmit and receive frequencies by pushing the C/SC/M along with the FUNCTION button.

You can select a frequency with either the ROTARY CHANNEL SELECTOR, or by direct entry to the keypad. You can adjust the channel steps with the 3/STEP and FUNCTION buttons along with the ROTARY CHANNEL SELECTOR knob. For repeater use, press the 7/SB button along with the Function button to switch from - offset to + offset to simplex operation. The offset is adjustable, too.

The Battery-Save function gives you even more choices. This function allows you to reduce the current drain to 1/3 during receiver standby. In this mode the receiver takes a sample once every single second. This is great for working voice out in the field, but it can be a problem receiving packet. Pressing the 5/SAVE button while pressing the FUNCTION button (located just above the PTT) toggles this feature on and off. The unit also has an Auto-Power Off function.

Midland shipped an accessory tone squelch board with the review unit. The Tone Squelch control allows you to gate a signal through the receiver squelch only when a particular CTCSS (Continuous Tone Controlled Squelch System) tone is being received. On transmit, you can similarly generate this particular subaudible tone to ac-

Specifications

Frequency Range	144-148 MHz TX, 130-170 MHz RX
PLL Lock Range	130-170 MHz
Modulation Type	F3
Channel Steps	5, 10, 12.5, 20, 25, 50 kHz
Antenna Impedance	50 ohm, unbalanced
Input Voltage Range	5.0-16.0 VDC
Nominal Voltage	7.2 VDC
Current Drain (approximate):	
Transmit	13.8V
	Hi 950 mA (5W)
	Mid 650 mA (2.5W)
	Low 350 mA (0.35W)
	7.2 V
	Hi 650 mA (2W)
	Mid 650 mA (2W)
	Low 350 mA (0.35W)
	Standby 0.35 mA
	Save 0.15 mA
	Auto pwr off 0.7 mA
RX	(144-148 MHz ham band only)
Sensitivity	(12dB SINAD) less than 0.16 μ V
20 dB quieting	Less than 0.25 μ V
Distortion	Less than 5%
Squelch sensitivity	0.16 μ V max
Audio output power 250 mW	10 % distortion at 8 ohms
TX	
RF output power	5W (13.8V) max
	2W (7.2V)
Max deviation	+/- 5 kHz
Freq stability	+/- 10 ppm from -20° C to +60° C
Spurious & harmonic emissions	Less than -60 dB
Dimensions	152 x 63 x 34 mm
Net weight	300 g (with battery and antenna)

Continued on page 37

Midland 73-005

Continued from page 35

cess "closed" repeaters or particular individual stations.

This miniature board took me all of 10 minutes to install, and five of those were spent looking for a small screwdriver. The clamshell housing comes apart lickety-split after removing just four screws. Inside there is a very neat array of microcircuitry. The thumbnail PC board sticks to the main board with its own adhesive backing and a tiny multi-pin plug makes all the connections. To operate the TONE SQUELCH feature, press the 4/T.SQ button while pressing the FUNCTION button. If you want to real get tricky, you can simultaneously utilize both the sub-audible TONE SQUELCH and DTMF CODE SQUELCH. Two independent subaudible tone frequencies

can be programmed into the memory banks. Tone frequencies are selected via the ROTARY CHANNEL SELECTOR.

Conclusions

For this review, I shoved the Midland 73-005 unit into my backpack, tossed it onto the passenger seat of my car, and clipped it to the handlebar bag on my mountain bike. It's been on hikes in the mountains, to the beach, everywhere. Let's cut to the chase. Money is important to most of us and this rig is priced quite reasonably. It offers more features than you will probably need. The receiver is hot and the rig is very sturdy. You can lock the PTT button and the operating mode to prevent improper operation. That's handy if you're active outdoors.

The speaker audio is very good. To get better audio you will probably have to fork

over quite a bit more money. I found this to be a cool radio, too. I didn't have a problem with the output power circuitry turning into a hot hamburger during normal use. (I don't usually rag-chew on 2 meters.) The aluminum chassis does a good job dissipating heat.


This is not the easiest HT to program. This article should give you a good feel of the essential operating hieroglyphics. Still, the Midland will perform well for you—just don't forget to bring the instructions along. The manual is detailed with plenty of illustrations to get you through.

Midland has made a triumphant return to the amateur radio business after a long hiatus. They have done a fine job with the 73-005 hand-held transceiver. Their next project is a UHF model, which is already in the works.

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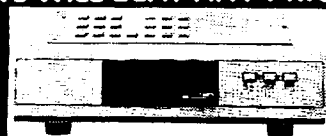
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Melt Your Way to Better Breadboards

Discover the Macro Surface-Mount breadboard method.

by Brad Thompson N1JJJ

Chances are, you build one or more breadboard versions of your amateur radio projects before you commit them to a printed-circuit board layout, or you may even skip the PC version altogether and simply package the breadboard.

But if the fun's wearing thin and you're "bread-bored," your standard construction method may be at fault—no single breadboarding method meets everyone's needs. For example, perforated grid board and wire-wrap techniques work well for logic and low-frequency analog circuits, but lack an adequate ground plane for RF applications.

Isolated pads carved into sheets of etched copper-clad laminate solve the RF ground plane problem but are totally immovable, as are through-hole Teflon stand-off insulators. Terminal strips soldered onto copper-clad solve the relocatability problem, but they're relatively bulky and add to board height.

Enter the Macro Surface-Mount breadboard method, or MSM for short. Using the MSM technique, you keep your breadboard's copper-clad ground plane intact and install connection pads wherever they're needed. You can easily remove unwanted pads and relocate their replacements and, as Photo A shows, you can even build breadboards on almost *any* substrate—from window glass to business cards.

Best of all, you won't tie up much "bread" in your breadboards—the raw materials cost a penny or two per connection, and the tools you'll need are available nearly everywhere.

What are the secret ingredients? The connection pads consist of disks of thin single-sided copper-clad printed circuit board laminate punched from sheet stock with a \$3 hand-held paper punch (see Photo B). Hardware-store hot-melt adhesive secures the pads to the ground plane.

Forming the Pads

Printed-circuit board material consists of one or two layers of copper foil laminated onto an insulating sheet. While most of us are familiar with the thicker sizes sold for fabricating one- or two-sided etched circuit boards, the PC board industry also uses millions of square yards of thinner stock to

manufacture the inner layers of multilayer boards.

For MSM breadboard applications, you can use single-sided epoxy/Fiberglass board (commonly designated as G-10 or FR-4 stock). Material of 0.012" insulation thickness laminated with 1-ounce (0.0014") copper works well—a common hand-held paper punch easily penetrates the laminate, and normal levels of soldering-iron heat won't delaminate the copper.

To create MSM connection pads, you slide a piece of laminate into your paper punch and squeeze. The pad will pop out like a miniature tidilywink unless you place a finger over the punch's exit side.

If the remaining laminate sticks to the punch, work it free with a twisting motion. To prevent cuts while handling the sharp-edged laminate, wear a pair of lightweight cotton gloves.

No one will ever mistake a paper punch for a precision tool, and the fit between

punch and die is typically rather sloppy. Thus, squeezing the punch forms a raised lip or burr on an MSM pad's copper surface. If you punch through the board's insulated side (i.e., with the insulation in contact with the steel punch and the copper side against the punch's die) the copper burr overhangs the pad's edges and reduces the insulation path.

Also, epoxy/Fiberglass material acts as an abrasive, further wearing the punch. When the edges of pads exhibit a torn rather than sheared appearance, discard the punch or relegate it to paper and cardboard.

MSM's Electrical Properties

While epoxy/Fiberglass laminate and hot-melt glues offer dielectric strength of approximately 500 volts and 650 to 1300 volts per mil of thickness respectively (i.e. a 12-mil board should withstand 6,000 volts), the practical working voltage for an MSM pad cemented to a ground plane falls well below the dielectric limit.

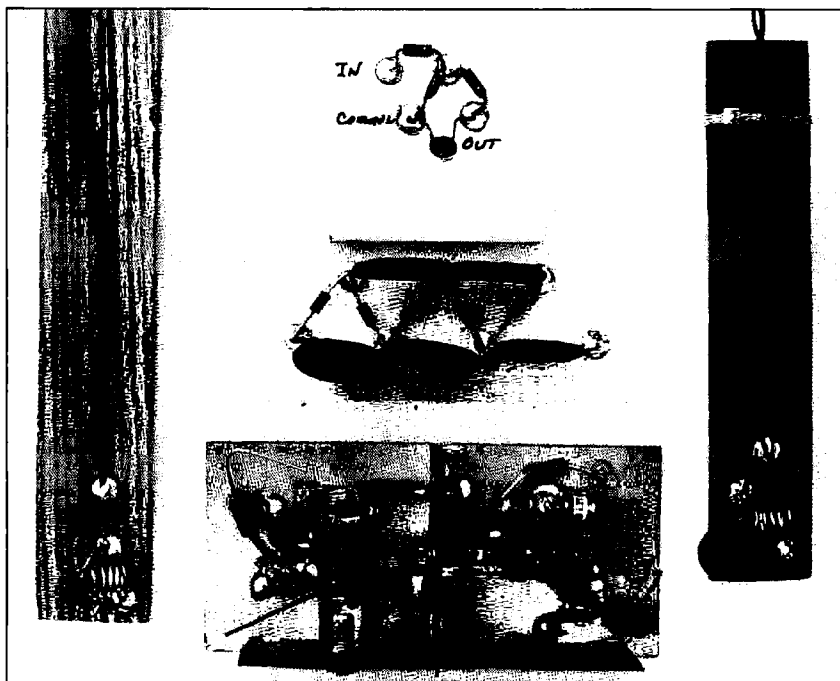


Photo A. Using MSM techniques, you can build circuitry onto almost any surface from plate glass to business cards to wood to Plexiglas.

In practice, the creepage path across an MSM pad's edge from copper to ground plane determines the voltage flashover margin. While a ring of hot-melt glue around and beneath a pad may raise flashover voltage, glue thickness and thus flashover voltage is hard to control.

As a guideline, printed-circuit board design rules impose a 150 volt limit for trace-to-trace clearances of 0.025". Thus, adopting a maximum working voltage limit of 50 volts for a 12-mil (0.012") MSM pad-to-ground plane separation will provide a conservative safety margin. Of course, if you're using an insulating substrate, pad-to-pad flashover and substrate breakdown voltage limits will apply.

Pad area and dielectric layer thickness value determine the capacitance of an MSM pad mounted over a ground plane. For a worst-case assumption of no glue layer, calculated capacitance of a 1/4" diameter copper pad and 12-mil epoxy/Fiberglass dielectric layer is 1.06 pF (picofarads).

In practice, edge effects increase and the thickness of a hot-melt glue layer decreases capacitance. A cluster of four MSM pads measured 1.08 pF per pad, a value reasonably close to the theoretical capacitance.

Dissipation factor (DF), a measure of a capacitor's AC power loss, varies from 0.001 to 0.120 for hot-melt adhesives, a range that brackets G-10 and FR-4 laminates' DF of 0.018—given the small amount of adhesive used, RF losses won't present a problem in most MSM breadboards.

Applying the Glue

Use a sharp hobby knife or single-edged razor blade to shave a 1/8" by 1/8" by 1/16" thick flake from a hot-melt glue stick. Size and thickness of the flake isn't critical, but too little glue won't fully wet a pad's underside and too much glue will form a messy-looking ring around the pad. A little practice will demonstrate the proper amount of glue to use.

Place the glue flake on the substrate using tweezers or needle-nosed pliers. Put an MSM connection pad (copper side up) over or against the flake. Using a small (20 watt) soldering iron, tin the pad's surface with 60/40 rosin-core solder.

As the solder melts, so does the glue, which secures the MSM pad to its substrate after cooling. While the glue remains liquefied, you can slide the pad to a slightly different location. If you incorrectly place a pad, simply reheat and remove the pad. Use a section of copper braid or solder wick to absorb leftover glue.

You can obtain MSM materials and tools locally, with the possible exception of thin-substrate copper-clad PC laminate. If your local surplus outlet doesn't stock the laminate, check mail-order surplus dealers who advertise in 73.

Also, contact local printed-circuit board manufacturers and PC laminate suppliers for availability of scrap and leftover material. To get started, you can purchase a 3" by 5"

trial sample, enough for over 200 MSM pads, from the author for \$4 postpaid (see address at end of story).

Assembly Techniques

BEFORE soldering a component to a pad, trim and tin all of the component's leads. Bend a lead to form a "foot" and place the "foot" on the pad. Apply a soldering iron to the lead and pad, simultaneously melting the solder and softening the glue. Adjust the pad's position, if necessary, and remove the iron. Allow the glue to cool for approximately 30 seconds before moving the part or bending its leads.

As noted, MSM pads can slide on a "bearing" of molten glue, but the first component lead soldered to the pad effectively pins the pad in place. While the first connection is the most difficult to make, subsequent connections go more easily.

Use a hemostat or locking tweezers to hold a component while soldering. Grasping the lead between component and connection helps keep excess soldering heat out of temperature-sensitive components.

For best results, use a low-wattage soldering iron—a 20 watt iron with a 1/16" tip works well. To solder leads to a copper-clad ground plane, use a larger iron of 40 to 50 watts capacity. Apply enough heat to make quick, clean connections and minimize softening of the glue securing adjacent component pads.

If you're installing MSM pads over a ground plane, use an ohmmeter to check for pad-to-ground short circuits caused by excess solder or too-long component leads.

To make connections between pads, use light-gauge solid- or stranded-conductor wire. Solid wires hold their shape when bent, an advantage when routing many conductors among pads. You can use thermally-strippable magnet wire for interconnections, but for best results trim and tin individual wires before soldering to pads. Tinned copper wire strung with sections of insulating tubing also works well.

Layout Suggestions

While the MSM method encourages a free-form approach to breadboarding, you'll get best results by planning your layout before you place a single pad. Proceeding from input to output, convert your schematic to a component-placement diagram. Allow a 1/4" circle for each MSM pad at a connection point. If you're using a copper-clad ground plane, allow a margin of approximately 1/4" to 1/2" around the ground plane's edge for mounting holes and a shielding box, if required.

Route power busses parallel with the sub-



Photo B. A tight-shot of the MSM connection pads.

strate's edges. In general, you'll find that MSM layouts can closely follow a circuit's schematic diagram, easing troubleshooting and modification.

Given a copper-clad ground plane, there's no excuse for insufficient RF filtering. You can liberally sprinkle bypass capacitors from MSM pads and power-distribution points to ground. When bypassed on either side, a low-value resistor passed through a clearance hole in a shielding partition serves as a feedthrough insulator.

You can use DIP (Dual-In-Line Package) components in a predominantly analog- and discrete-component MSM layout via "dead-bug" and "porch" techniques. In the dead-bug approach, you place the part with its pins in the air and bend power and ground pins to contact MSM pads and the ground plane respectively. Use individual pins as connection points for wiring—AWG #30 wirewrapping wire works well.

As an alternative, you can mount DIP components on sections of perforated board or salvaged printed-circuit board, wiring the ICs as a socketed subassembly and then securing the "porch" board to the ground plane with hot-melt adhesive. If your design consists mostly of DIP components, build the circuit on perfboard and tack on discrete parts via MSM pads.

If you experiment with nontraditional circuit substrates (e.g., cardboard or unused ashtrays), consider the substrate's mechanical and electrical properties. While an MSM pad and its glue provide a margin of insulation, wood, paper and cardboard lose mechanical strength and can become conductive when wet, causing electrical sneak paths.

Glass and plastic substrates offer superior insulation but require careful handling and mechanical mounting. In general, remove dirt, grease and corrosion products from surfaces before applying hot-melt glues. Otherwise, MSM pads may separate from the substrate due to poor glue bonding.

You can use a transparent plastic box with a removable lid as an enclosure for an MSM circuit by building the layout on the box's lid. However, the plastic may soften beneath each MSM pad, so apply minimum soldering heat for best results.

If you're uncertain about selecting a particular combination of substrate and hot-melt glue, conduct a pull test by attaching an MSM pad to the substrate and soldering a

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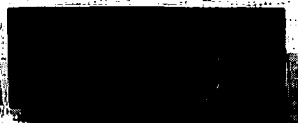
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1/4 watt resistor to the pad. Allow two minutes for the glue to bond. Secure the substrate in a vise.

Using pliers to grasp the resistor's unsoldered lead, apply a steady pull at a 45-degree angle with respect to the substrate. If the glue bond fails before the resistor fractures or the soldered connection peels, choose another glue or substrate.

When assembling an MSM breadboard, remember that bends in a component's leads help alleviate mechanical stress induced by soldering heat. Also, raising a component's body above the substrate improves heat dissipation and provides clearance for cross-under wiring.

Depending upon formulation, hot-melt glues soften at temperatures ranging from 70 to 163 degrees Celsius. Therefore, avoid designs that heat the substrate or dissipate large amounts of power into MSM pads via component leads. Provide longer component leads for extra cooling.

Assembly Ideas

As an alternative to a paper punch, you can use sheet-metal snips or even heavy-duty scissors to cut rectangular pads and bus strips. However, circular pads are free of sharp corners which can cause short circuits.

Lightweight copper-clad material forms easily-assembled shielding partitions and enclosures. Use EMI-suppression conductive adhesive-backed copper tape to form corners of shields and for seam coverage. For permanent tape-to-substrate bonds, tack-solder the tape and substrate at 1/4" intervals.

Hot-Melts for Hams

If your workshop includes an electric glue gun, chances are you're already familiar with the varieties and brands of hot-melt adhesives typically stocked by hardware stores. If not, here's a review of what's available.

Hot-melt glues come in three varieties. Polypropylene adhesives are yellowish white in color and slightly translucent. Ethylene vinyl acetate (EVA) glues are colorless and translucent. Polyamide glues are opaque and dark amber in color.

You'll find all three types in 1/2" or 1/4" diameter sticks of various lengths. You'll also find hot-melt sealants and caulking compounds—avoid these, as they don't adhere adequately for MSM applications.

In exploratory pull tests, all three types of hot-melt glues provided strong bonds—typically, components' bodies fractured before either solder or glue bonds ruptured. However, pads secured with white sealer/caulking compound failed during a moderate pull, well before component failure occurred.

Peel strength of copper on G-10 or FR-4 board stock is approximately eight pounds per inch of width. Various hot-melt adhesives offer peel strengths ranging from 13 to 45 pounds per inch of width, and thus an MSM pad's foil-to-Fiberglas

If you're modifying or repairing a conventional printed-circuit board, use MSM pads as tie points for discrete components. While it's preferable to secure MSM pads to an area of ground plane, in most cases you can also cover signal traces with pads. Trace-to-pad capacitance will amount to only a fraction of a picofarad per pad, and stray signal coupling shouldn't present problems.

Drawbacks to MSM technology include a tendency for reheated pads to slide on a glue "bearing." Use a scribe or soldering aid tool to hold a recalcitrant pad in place. Also, after repeated soldering and unsoldering, a pad's glue bond may weaken, forcing you to replace or reglue the pad.

Hardware built with MSM breadboards tends to spread in two directions, forming shallow layouts that are great for troubleshooting but somewhat hard to package for some applications.

While the author has used MSM technology for several months, MSM remains an experimental assembly method—long-term effects of storage, shock and vibration resistance, and repeated thermal cycling remain unexplored. In the tradition of amateur radio experimentation, the author releases MSM technology to the public domain. Your comments are invited.

NOTE: To obtain a 3" by 5" sample of 12-mil single-sided copper-clad laminate for experimental MSM pad fabrication, send a check or money order for \$4 (U.S.) postage and handling to: Brad Thompson N1JJJ, 100 Powdermill Rd., M/S BX-233, Acton MA 01720.

bond will fail before the actual glue bond between pad and ground plane fails.

A \$0.25 single glue stick yields hundreds or thousands of connections, and a carton of sticks probably represents a lifetime supply for most amateurs. However, hot-melt adhesives offer all kinds of interesting possibilities and chances are, you'll use more than you expect.

Beyond MSM assembly, hot-melt glues offer additional applications for amateur radio. For example, you can tack wires in place, secure heavy or bulky components to a substrate, and mount subassemblies in cabinets. However, hobbyist-grade glue guns typically provide poor control of glue flow and produce unwanted stray filaments of glue.

Use a clean soldering iron operating at reduced voltage via a variable-AC transformer to daub beads of melted glue stick where needed. Hot glue adheres to everything (fingers included) and can cause burns, so wear gloves and use caution when applying the glue. Periodically wipe the iron's tip on a damp sponge to remove overcooked glue residue.

When applying hot-melt glue to large metal objects, note that the metal acts as a heat sink and may weaken glue bonds. Warm the metal beforehand for best adhesion.

Maxi-Loop 80

Here's a tried-and-true indoor favorite you can build.

by Richard Q. Marris G2BZQ

Those of us who frequent the lower HF bands (80 and 160 meters) know that sometimes the signal we want can sink into the ambient noise and disappear. This applies to both amateurs and shortwave listeners. The noise in question appears to be an amalgam of a number of sources—some radiated, some atmospheric, and some man-made.

Many hams resort to the use of a multi-turn tuned loop antenna for reception. Unfortunately, many are then disappointed with the resulting lower signal strength. Still, the loop's directional properties can reduce some of the noise. So, a preamplifier is inevitably used between the loop and the receiver. This increases signal strength, but also amplifies the noise.

Such lower HF loops are usually capacitor-tuned multi-turn affairs, with a single coupling turn. The loop's wire turns are spaced close together or are even touching.

The loop receiving antenna has been with us since the first days of wireless. It is usually seen in the form of a small-space domestic antenna. It is also used for direction finding (DF), especially in ships fitted with earlier radio telegraphy equipment. I know, because I collect old wireless books and I often used physically small-size MF and lower HF direction finding loops dur-

ing WWII. Their performance was often impressive.

A review of the literature shook my poor old brain box, producing the realization that these older-type loops were mostly

"The loop receiving antenna has been with us since the first days of wireless."

very, very efficient, small in size, and very sensitive. They usually had their multi-turns spaced well apart. I also recall that during more recent experiments with multi-turn small-dimension transmitting loops, the problem called "proximity effect" had

been encountered, usually from the wire turns being too close together. The proximity effect may occur in cases where insulated turns are close-wound (e.g. one wire turn apart). As the turns are brought close to each other, the current density around the circumference of each conductor gets redistributed. The result is a loss in sensitivity or signal strength. For any reader who is interested, the proximity effect is analyzed more deeply in the *ARRL Antenna Book* (16th edition), and in other textbooks.

I decided to experiment to try and improve the loop's sensitivity (i.e. signal strength) and selectivity (to reduce the ambient noise level and other interference). The experiments compared various turn spacings and various methods of coupling to the receiver. For the initial experiments, a convenient suitable-size cardboard carton was used as a simple frame. A reel of PVC covered hook-up wire and a roll of masking

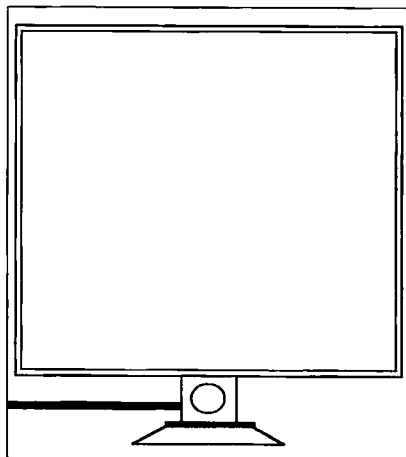


Figure 1. Maxi-Loop 80 antenna profile.

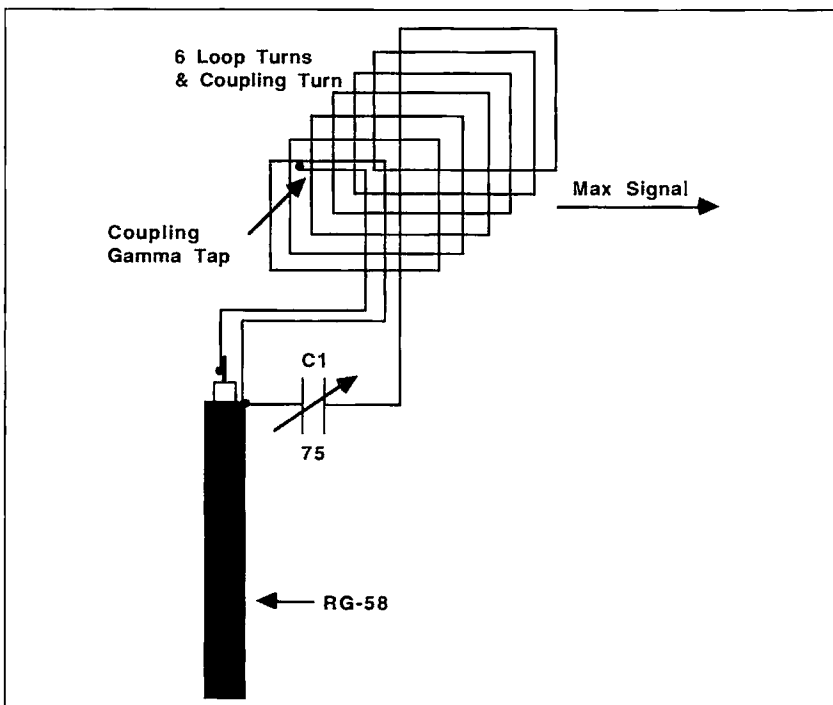


Figure 2. The antenna's electrical circuit.

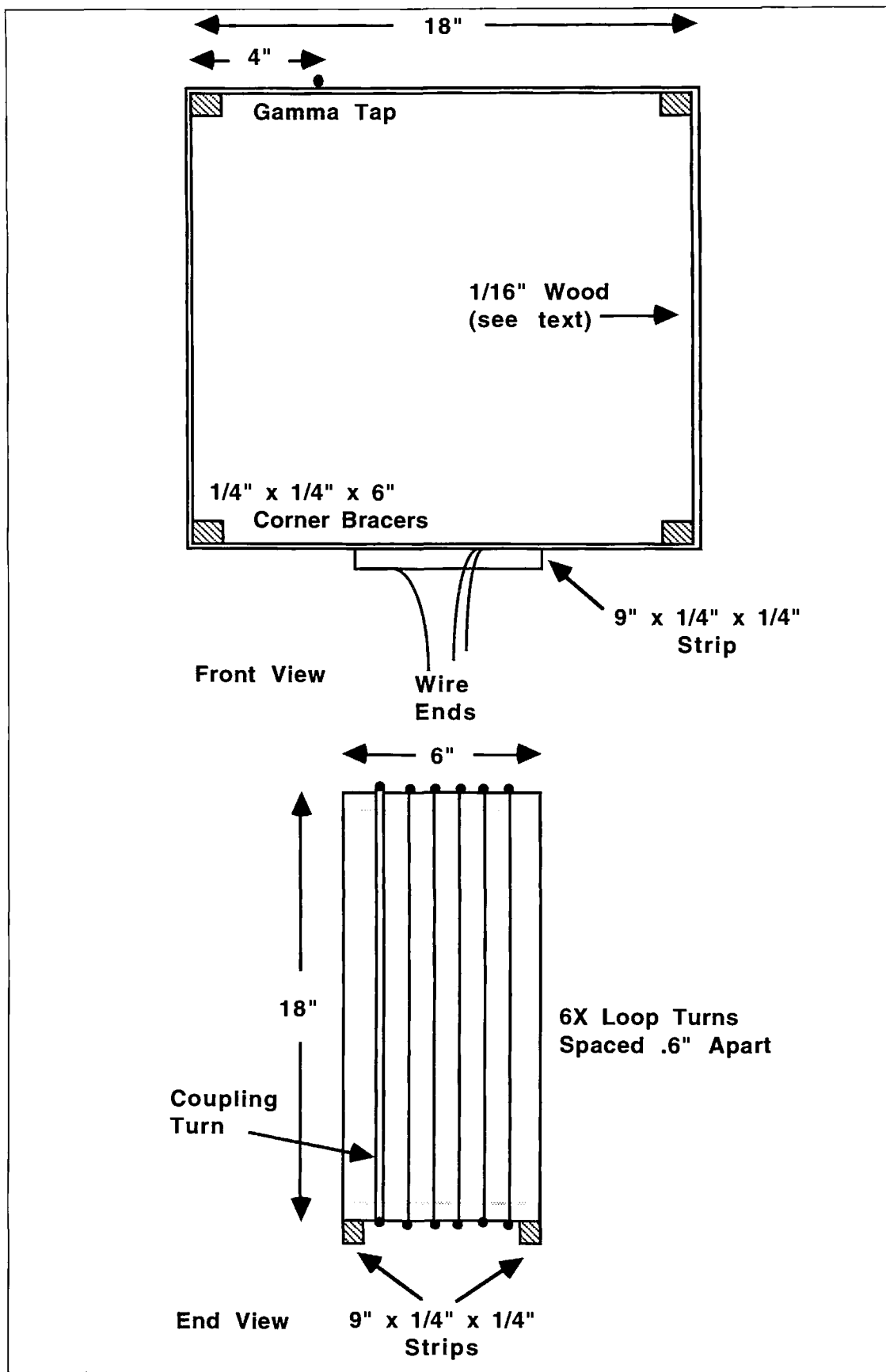


Figure 3. The Maxi-Loop 80's frame and winding.

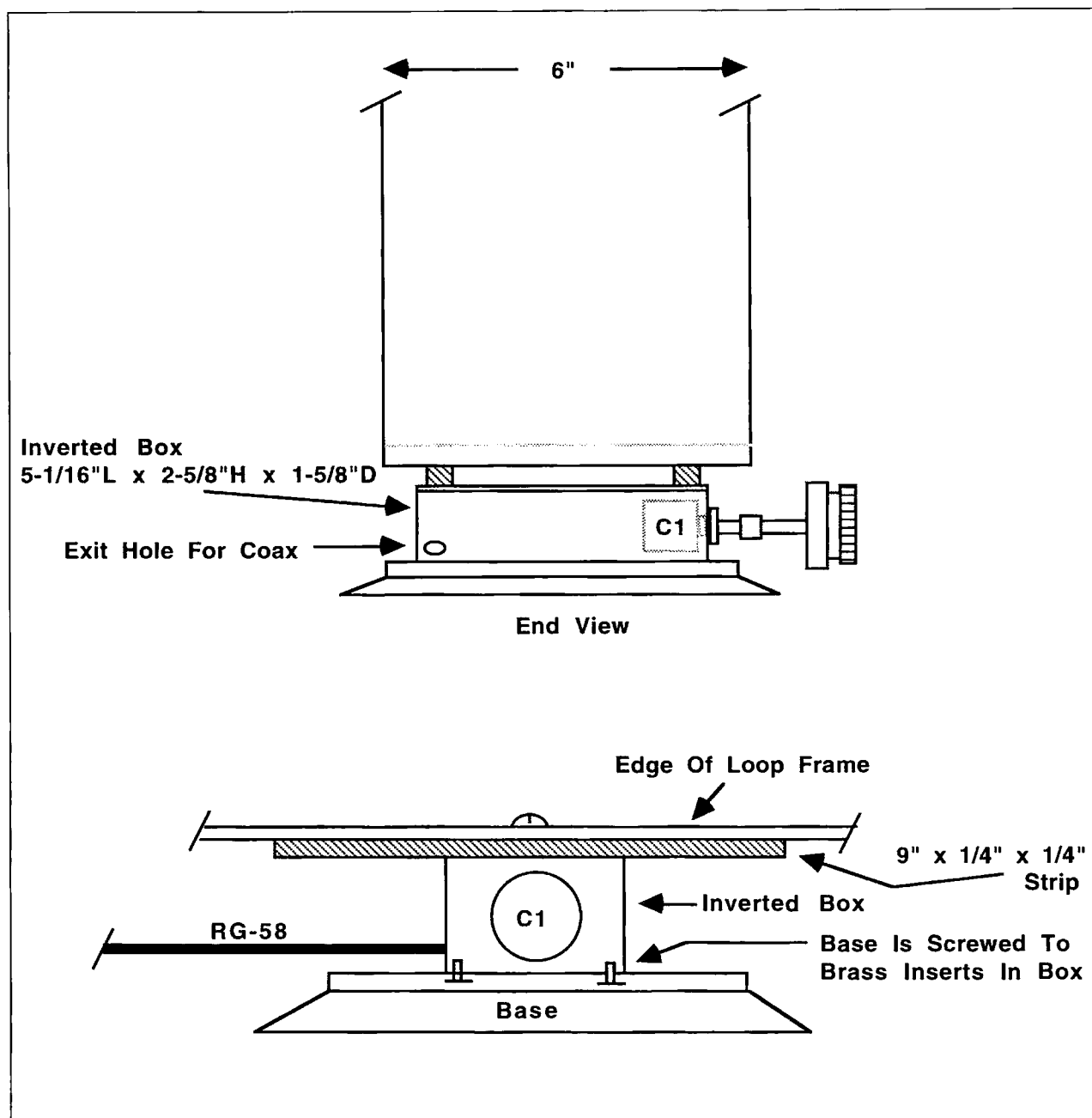


Figure 4. Mounting the antenna frame on the box.

tape held things in place and allowed for quick alterations. After several hours' work, using a frequency around 3.5 MHz, I wrote down a loop specification:

1. To be usable indoors, the loop must be small, lightweight, and decent to look at.

2. The goal is maximum sensitivity (i.e. greatest signal strength) with maximum selectivity.

3. A minimum of $1/8$ wavelength of wire would be necessary, as performance falls off when proceeding with much less.

4. The estimated size was $18" \times 18" \times 6"$ using six wire turns spaced at $0.6"$ apart, from conductor center to conductor center.

5. A form of gamma match coupling

would be used in preference to the usual loop coupling turn.

6. To obtain the absolute best results the loop would be an 80 meter band monobander.

Design Description

The resulting loop profile is shown in Figure 1. The loop frame is neatly pivoted on the flared base with a small plastic box, which encloses the resonating variable capacitor and sundry wiring.

The circuit, Figure 2, shows a six-turn loop resonated by a 75 pF variable capacitor. The coupling to the receiver is a form of "gamma" match which, in the original

cardboard carton experiments, was proved to provide better sensitivity than the more typical coupling turn. The frequency range is 3000-5000 kHz, with excellent sensitivity. Note: If C1 is replaced with a 200 pF variable capacitor, this will give a frequency range of 1750-5000 kHz, with performance falling off somewhat below 2500 kHz but still usable. A slow-motion drive would then be required with $C1 = 200$ pF.

The resulting performance, throughout the 80 meter (3.5 MHz) band was lively, with a high degree of signal strength and good selectivity reducing the ambient noise level substantially. A preamplifier was not necessary with a good superhet communi-

cations receiver, and this is with the loop on a table indoors alongside the operating position. However, it must be remembered that the results from such a loop may vary from location to location and operator to operator.

Construction

The lightweight box-style mainframe is shown in Figure 3. It consists of four obeche wood panels 18" x 6" x 1/16". (Obeche appears to be similar to balsa wood, but stronger.) Of course, 1/16" ply, or other wood, could be used, with an increase in weight.

The four panels 18" x 6" are corner-glued together, with 1/4" x 1/4" molded wood corner bracers, as shown in Figure 3. Two 9" x 1/4" x 1/4" mounting/bracing strips are glued at the bottom, as shown in Figure 3.

Onto the frame wind six counter-clockwise turns of PVC-covered single-conductor 0.6 mm-diameter hookup wire, with the turns spaced at 0.6" apart from conductor center to conductor center. The same wire is used for the gamma match coupling turn, which is tapped onto the main winding 4" from the top left-hand corner (Figure 3) of the first turn. It is run alongside the first loop turn and touching it as shown in the circuit. The turn's ends (about 3") are secured by running them through small holes drilled in the 9" x 1/4" x 1/4" bracing/mounting strips, and they can be pruned back later during wiring. To keep the turns exactly 0.6" apart, a blob of glue should be placed on them at the frame corners. Note: After initial tests, the loop frame (and turns) should be varnished outside and inside with polyurethane varnish. This makes the somewhat flimsy loop frame/winding (Figure 3) quite rigid.

Figure 4 shows the plastic box (5-1/16" x 2-5/8" x 1-5/8"), which has a thin metal lid fastened with four corner screws into brass threaded corner inserts. The metal lid is not used.

First, C1 is mounted in the box end center, as shown, and the mainframe loop is secured to the box with two screws with washers and nuts (Figure 4). The two screws pass through the 9" x 1/4" x 1/4" bracing strips, and the inverted plastic box.

Using the discarded metal box top as a drilling jig, drill four holes through the flared mounting base, which is a rigid, colored plastic picnic plate, which loses its original identity when inverted and screwed to the box.

The RG59 coaxial feedline to the receiver is brought through a hole in the side of the plastic box, as shown, and is 48" long. It is cleated to the inside of the box.

After completing the simple wiring in-

side the box, the inverted plastic plate is screwed to the box.

Testing and Operation

After plugging the coaxial feedline into the receiver, which is tuned to 3500 kHz, C1 is rotated to resonance. This is repeated at 3800 kHz (4000 kHz in the U.S.A. and some other countries). There should be a frequency overlap at either end of the 80 meter band. The prototype tuned from approximately 3000 to 5000 kHz.


Tuning to various stations over the 3.5 MHz band, you should find that there is very adequate signal strength, with excellent selectivity and low ambient noise. The directivity of the loop is the usual figure-

"It is absolutely essential that the loop is deactivated on transmit, otherwise the whole transmitted power will arrive at the receiver input, with quite devastating results."

eight polar diagram, with maximum signal off the ends, and minimum on the flat side of the loop. However, due to the coupling method employed, one lobe is larger than the other. Though the purist may shudder at this, it is an advantage as it reduces other unwanted stations' interference on the reciprocal bearing (i.e. 180 degrees), and is a quite deliberate feature of the design. I haven't needed a preamplifier as there is quite adequate signal strength with the loop indoors at this location in a built-up area. The loop should be kept well clear of the room walls and metal objects and wiring and pipes, etc.

Using a 2 watt QRP transmitter as an experiment, it was possible to load up the loop. However, with those thin loop wire conductor turns, it is unlikely that the transmitted results would be very acceptable.

Though the construction is very simple, it must be followed as closely as possible as the design has been targeted at the 80 meter band only, and I've been somewhat amazed how critical the turn spacing appears to be to get maximum signal strength.

The transmitting amateur will obviously be using the loop with a receiver, and the main antenna on the transmitter. It is absolutely essential that *the loop is deactivated on transmit*, otherwise the whole transmitted power will arrive at the receiver input, with quite devastating results. The method that I adopted is to "short" the RG58 loop feedline at the point where it enters the receiver. This can be done with a manual switch, relay, or RF-operated device. Whatever the method adopted, it should be tried with great care at low power and then at gradually increased power. 

References

The following are some of the textbooks used for reference. The first two are readily available, whereas the others are collector's items. Such older textbooks should not be scorned, as the conclusion that I've reached is that some of the older loop designs were probably superior to many of the present-day designs. Such books can often be found at flea markets, etc.

1. *Antennas* by J. Kraus.
2. *The ARRL Antenna Book*, 16th edition.
3. *The Admiralty Handbook of Wireless Telegraphy*, 1938.
4. *The Radio Designers Handbook*, 1953, by Langford-Smith.
5. *The Handbook of Technical Instruction for Wireless Telegraphists*, 1942, by H.M. Dowsett and L.E.Q. Wallen.
6. *Radio Techniques*, by A.G. Mills, 1943/44.
7. *Outline of Wireless*, by L.B. Turner, 1921.
8. *Measurements in Radio Engineering*, by F.E. Therman, 1935.

Parts List

1	Box	5-1/16" x 2-5/8" x 1-5/8"	Tandy/Radio Shack 270-233
1	Variable capacitor(C1)	75 pF	Jackson C809 or C802, or similar small ceramic variable capacitor
4	Obeche	18" x 6" x 1/16"	Or alternatives—see text
1	Length moulded wood	1/4" x 1/4"	
1	RG58 coaxial feedline with suitable coaxial plug	48"	
1	Baseplate (see text)		
1	Knob and extension shaft for C1		
1	50-foot reel of PVC-covered single-strand wire		0.6 mm conductor

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knights Way Drive
Houston TX 77083

New Satellites in Orbit

A one-day delay due to poor weather conditions was the only snag in the launch of four new satellites carrying amateur radio payloads. Conditions for launch require that wind speeds not exceed 30 mph, horizontal visibility be at least 1,970 feet, and the cloud ceiling be 820 feet or higher.

On September 26, 1993, at 0145 UTC, the 59th rocket of the European consortium Arianspace lifted off from its South American launch pad carrying seven satellites bound for an 800-km-high polar orbit. The sidebar shows the sequence of events following engine ignition. While this launch was the 31st for an Ariane 4 booster, it was only the third time an Ariane 4 had been used without any strap-on boosters and the fourth time for the ASAP (Ariane Structure for Auxiliary Payloads) platform. The ASAP is a donut-shaped mounting plate for small satellites near the base of the main payload.

The Ariane 40 used for V-59 stands 180 feet tall with a lift-off mass of 240,000 kg. It is a three-stage vehicle capable of placing 4,670 pounds of payload into the desired polar orbit. The first stage (L220) is built by Aerospatiale, and is powered by four liquid-fueled Viking V engines. The second stage (L33) is built by MBB Erno, and is powered by a single Viking IV engine. The first and second stages use a biquid fuel. The third stage (H10) is built by Aerospatiale, and is powered by a cryogenic liquid hydrogen and oxygen fueled HM-7B engine.

Most Ariane launches are for communications satellites destined for geostationary orbits over the equator. The main payload on V-59 was SPOT-3, an earth observation satellite used for earth imaging and mapping. Its mass is almost 10 times that of all the other satellites on the mission.

Of the six small satellites launched, two were based on the microsat design from AMSAT-NA, four were of SSTL (Surrey Satellite Technology Ltd.) design, and one, *Stella*,

was a space geodetic satellite from CNES (Centre National d'Etudes Spatiales). *Stella* was mounted under SPOT-3, inside the payload adapter.

The two microsat-type satellites were ITAMSAT, now known as ITAM-SAT-OSCAR-26, and EYESAT-A, now called AMRAD-OSCAR-27. Both were built from designs originally from AMSAT-NA, but with changes and upgrades. IO-26 is dedicated to amateur radio service while AO-27 is primarily for commercial uses and was constructed by Interferometrics, Inc. of Vienna, Virginia.

The three SSTL-style spacecraft include KITSAT-B, now known as KITSAT-OSCAR-25, POSAT-1, which may be named POSAT-OSCAR-28 and HEALTHSAT-1. K-O-25 from SaTReC (Satellite Technology Research Center) of Korea is dedicated to amateur use. PO-28 from LNETI in Portugal is primarily to stimulate space application efforts in Portugal and may be available for some ham operation. HEALTHSAT-1 from SSTL is to be used by medical schools, universities, hospitals and documentation centers in Africa. It carries no equipment for amateur radio use, although its downlink is in the 420-430 MHz band. In Europe this is not a ham band.

The first signals heard from the new hamsats were those of AO-27 on 436.8 MHz. Within a day all of the satellites had been heard and were being loaded with software and successfully commanded by ground stations. The SSTL craft carry 16.5-foot-long gravity gradient booms that are deployed after all tumbling motion has been dampened by on-board computer control. PO-28 and HEALTHSAT-1 were both stabilized within a few days. Boom deployment was accomplished first on PO-28 and later on HEALTHSAT-1 by SSTL. Control of KO-25 was accomplished from the group in Korea.

Last month's column contained descriptions of the frequency plans for the new hamsats and further data on their operation. While they will provide more digital communications for hams on earth, other onboard experiments like KO-25's color camera will furnish new excitement for those interested in the scientific aspects of amateur radio satellites.

The End of ARSENE

On September 25th a group of French ground-control stations for *ARSENE*, the recently launched French hamsat, made a series of attempts to recover control of their satel-

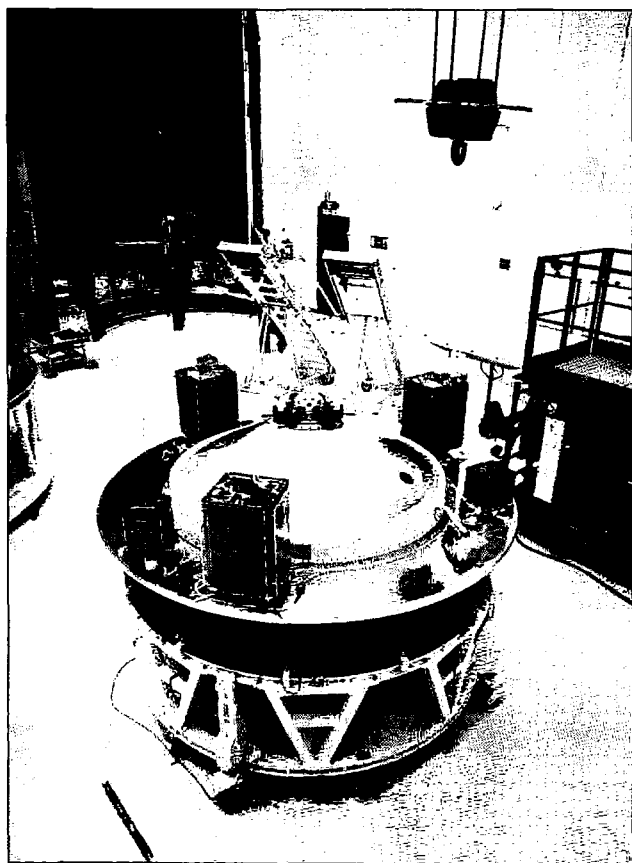


Photo A. Preparing the microsat payloads for the V-59 flight. (Arienspace photo.)

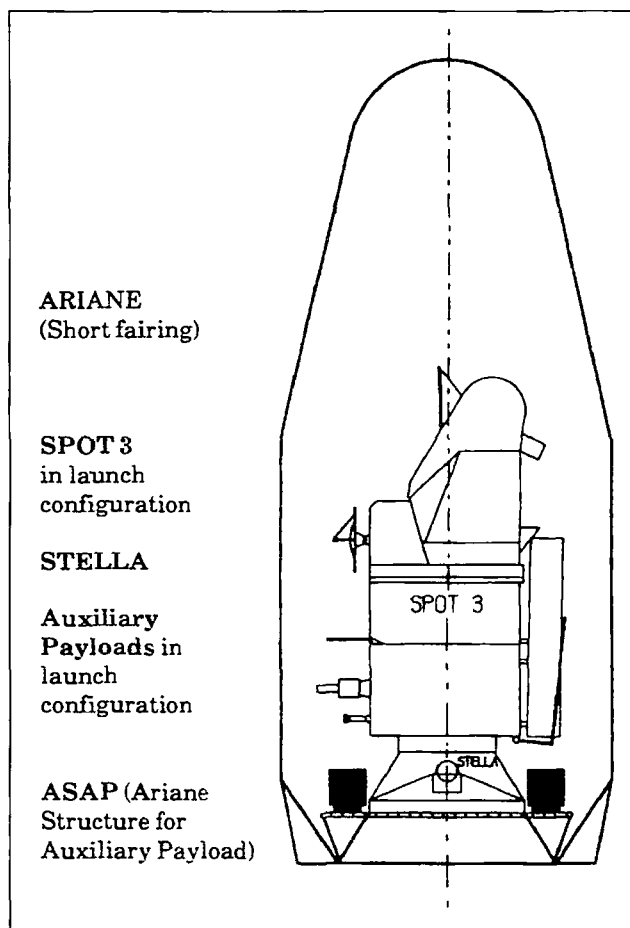


Figure 1. Ariane payload flight configuration. (Arienspace drawing.)

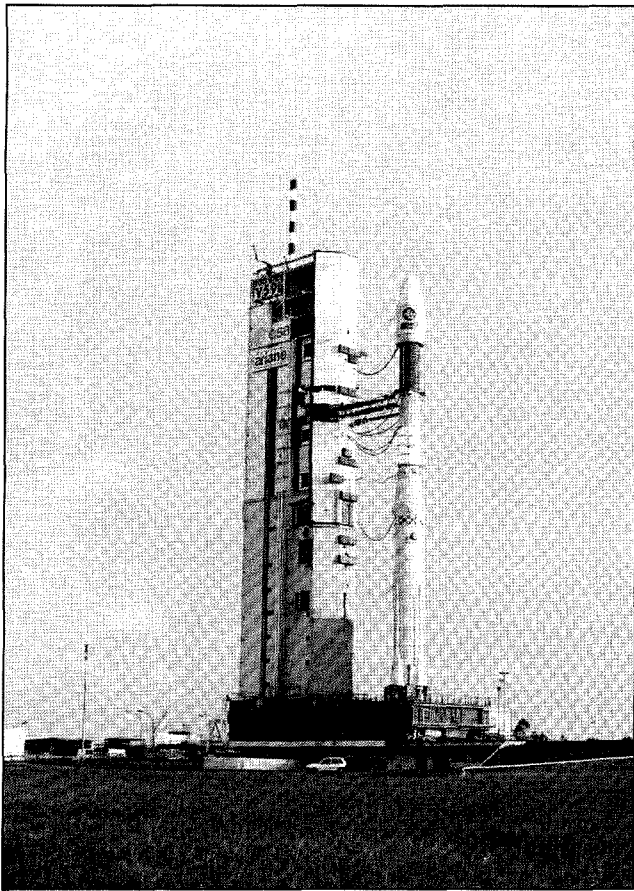


Photo B. The ARIANE 40 launch vehicle (without strap-on boosters) into preparation on its table before liftoff, Kouru, French Guiana, September 25, 1993. (Arianespace photo.)

lite. Since launch, *ARSENE* has had problems. The 2 meter transmitter did not function and commands to the satellite were not always executed.

The F5ELL UHF moonbounce station was used to send a long series of telecommands on 70cm to *ARSENE*. The F5ELL system includes a 26-foot parabolic dish and 2,000 watts power. F5PL monitored the *ARSENE* downlink on 2.4 GHz with a 23-foot dish. Nothing was heard after several at-

tempts. It is likely that the satellite has experienced a catastrophic failure. Some efforts will be made to regain control, but prospects are not high in France.

Many stations made contacts through the *ARSENE* transponder. It is hoped that the groups responsible for this ambitious satellite will use the experience gained to build another.

73

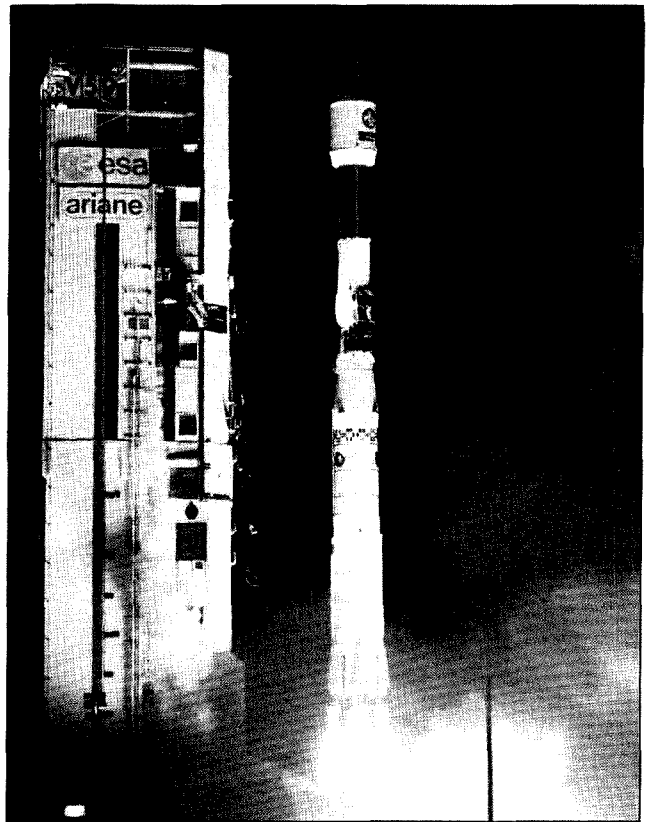


Photo C. Liftoff of the ARIANE 40 launcher (without strap-on boosters), Kouru, French Guiana, September 25, 1993. (Arianespace photo.)

Flight Profile of V-59

00:00	Ignition
00:04	Liftoff
02:39	First stage separation
03:48	Fairing jettison
04:48	Second stage separation
04:53	Third stage ignition
16:44	Third stage shutdown/orbit injection
17:17	SPOT 3 separation
20:39	STELLA separation
22:56	KITSAT, POSAT, HEALTHSAT separation
24:27	EYESAT, ITAMSAT separation
26:34	Third stage avoidance maneuver
29:00	End of Ariane mission 59

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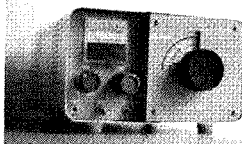
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Last month, I hinted at a modification to the Flesher RTTY terminal unit that would enable it to run as an interface to some of the popular RTTY software. This month, thanks to information provided by Joe Masur AA5YA, of Perkins, Oklahoma, I can offer a way to accomplish this transformation.

This modification is for the Flesher TU-470 terminal unit. I do not have information regarding other Flesher units, but I'd like to hear of information developed in this vein by any of you.

General Information

Begin by unplugging the unit and removing the two rear screws. Slide the modem out of the case. Remove the one screw holding the main fuse and push it aside. For RS-232 operation, it is advisable to disable the loop supply by lifting CR7 and CR8. Then install a 4.7k 1/4 watt 5% resistor in the resistor position marked with "RX" between R20 and R25.

If you don't like to make up plugs, you can purchase a Radio Shack female DB9 to female DB9 serial cable, and cut it in two. You will have a spare three-foot piece for later use. All the cables will fit inside the DB25 connector housing.

You will have to enlarge the outlet hole some, or pick one that will fit. You can also purchase three Radio Shack audio cables, double male, and cut them in two, as you will need five total: three to the radio and two to the scope. You could add the extra cable and then have the choice of operating AFSK or FSK. When marking the quad board, mark jack, and the DB9 connector locations, leave enough room at the outer edge for the terminal unit case.

All of the cable grounds do not have to go to any special pins on the terminal unit, but pins 23 and 24 are not used. Use pins from 15 to 22 to make up the neatest arrangement, in any order possible.

Quad Jack Phono Board

Unsolder and remove the 25-pin connector from the PC board. Be careful not to damage the solder-through pads. Line up the quad jack board on the inside of the unit and mark with a pencil at each end on the

Switches Reversed And Vertical For Clarity

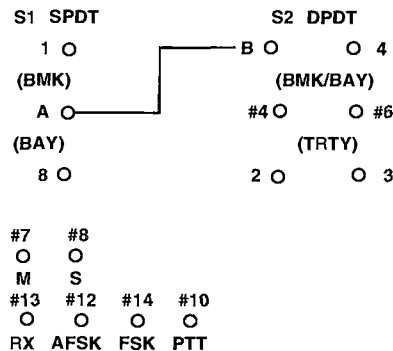


Figure 2. Switch detail wiring.

rear frame. With a small file or Dremel tool remove 3/16 inch of the PC board between your pencil marks, or until there is enough room to insert the phono board. Mark and drill the mounting holes for the phono board and set aside.

DB9 Connector

Remove the loop supply plug and unsolder the lead to the PC board. Mark and form this hole to fit the connector and drill the two mounting holes. Cut and solder a three-inch length of proper color-coded wire to each of the eight pins and set aside.

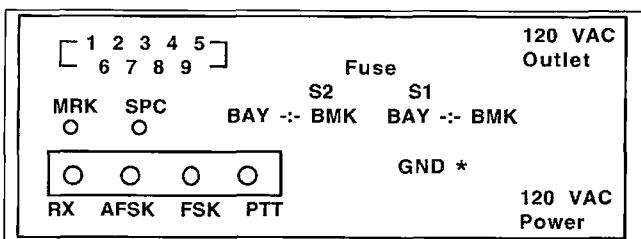


Figure 1. Flesher TU-470 rear view. Not to scale.

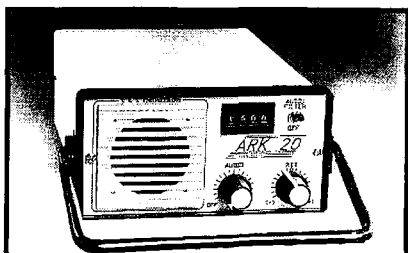
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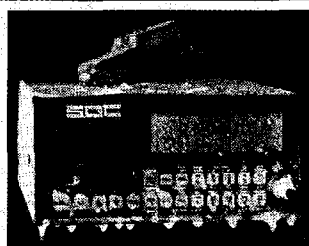


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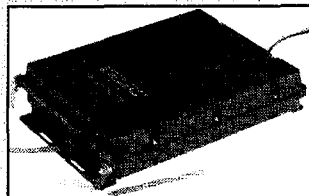
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"BURN-IN" rack and keyed down for 24 hours non-stop at full power CW. Don't try that with the foreign radios. 4) EVERY SG2000 is then re-checked for alignment and put in the "TORTURE RACK" where they are keyed on and off every 10 seconds for 24 hours. 5) The SG2000 is then re-evaluated and all control functions are verified to ensure that the microprocessor is up to spec. THEN AND ONLY THEN IS THE SG2000 ALLOWED TO LEAVE THE FACTORY.

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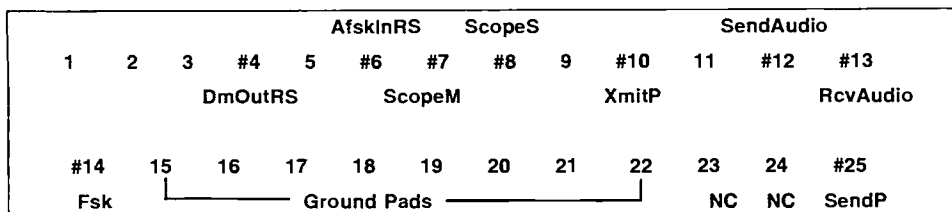


Figure 3. PC board connections.

Scope Outlets

Locate the two scope outlets between the phono jack board and the DB9 connector. Mark and drill the 1.4-inch mounting holes. Solder on wires as above and set aside.

Switches

Find the correct placement for the switches. Check to see that the fuse block can be mounted and that there is clearance, then drill a 1/4-inch hole for each switch. Do not install.

Wiring and Mounting Quad Board and Scope Jacks

Cut all lead lengths for neatness and short runs while making the con-

nections. Solder all the ground lugs on the quad board in series with one wire with enough lead on one end to go to the ground lug on the terminal unit and the other end to go to the scope outlet ground lugs. Solder a three-inch wire to each center lug on the quad board and mount the board. Install the scope jacks. Solder the quad board ground wire to the terminal unit ground lug and the other end to the scope jack ground lugs. Then add one more wire to any convenient ground pad on the PC board and back to a scope jack ground lug.

Solder the four quad board and the two scope wires to the following PC board pads:

10	PTT	(XmitP)
12	AFSK	(SendAudio)
13	RX	(RcvAudio)
14	FSK	(Mark/Space)
7	MARK	(ScopeM)
8	SPACE	(ScopeS)

DB9 Connector and Switches

Install the connector and solder PC board wires:

5	BLUE	(Signal Gnd)	to a ground pad
7	GRAY	(SendP)	to pad 25

Solder a three-inch wire to #4 and #6 on S2 and install. Solder one three-inch wire to A on S1 and install. Solder

A-S1 to B-S2 and to the PC board solder:

#4 to pad 4 (DmOutRS)
#6 to pad 6 (AfskInRS)
From the DB9 connector solder wires:
1 (RED) and 8 (WHITE) to S1
4 (GREEN), 2 (ORANGE), and 3 (YELLOW) to S2.
*** DOUBLE-CHECK YOUR WORK! ***

Mount the fuse block and the fuse. Slide the modem back into the case and secure with the two screws. This completes the modification to the terminal unit.

Any communication program that uses pins 2, 3, 5, and 7 of the run using the TRTY position. Operation details include the following:

Terminal Unit:	Serial cable to computer
	Front panel push-buttons to correct shift, etc.
Cables:	RX to radio audio OUT
AFSK:	AFSK to radio audio IN
	PTT to radio PTT jack
FSK:	FSK to radio MARK/SPACE/FSK input jack
	PTT to radio RTTY/KEY jack
Switches:	S1 S2
	BMKMULTY
	BMK BMK (set software to TXR1/RXR1)
	BAYCOMM
	BAY BMK TRTY
	NC TRTY

Now, I defer to Joe for all of the in-

Parts List		
#	Description	Radio Shack No.
1	Quad Jack Phone Board	RS-274-322
1	Pkg. shielded phono jacks	RS-274-346
1	DB9 male connector	RS-276-1537
1	SPDT toggle switch	RS-275-613
1	DPDT toggle switch	RS-275-620
3	3-foot audio cables	RS-42-2366
1	RS232C female/female cable	RS-26-116

RS232C Interface Data			
PIN 1	RED	DCD	BMKMULTY RX
PIN 2	ORANGE	RXD	TRTY RX
PIN 3	YELLOW	TXD	TRTY TX
PIN 4	GREEN	DTR	BMK/BAY TX
PIN 5	BLUE	GND	SIGNAL
PIN 7	GRAY	RTS	PTT/FSK KEYING
PIN 8	WHITE	CTS	BAYCOMM RX
PIN 9	BLACK	RI	BMKMULTY FAX/TUNER

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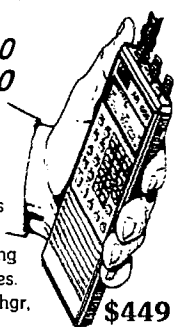


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formation on this rather extensive, but useful, modification. As he points out, with the ability of the Flesher TU-470 to work on these modes, there is no reason to cart one of these off to the flea market. Conversely, if you spot one at a bargain, you might just be inclined to give it a shot.

I look forward to hearing from you all, with the results of such future efforts. Thanks to Joe for the hard work, and all the information.

Now, having done all of this, getting the software to run with is a piece of cake. Just send a self-

addressed stamped envelope for a current list of the "RTTY Loop" software disks, collections of programs available for the IBM PC compatible computers out there. Email sent to me on CompuServe (75036.2501), Delphi (MarcWA3AJR), or America Online (MarcWA3AJR) will be similarly answered. I look forward to your comments and questions online, or in the mail. I hope all of you have a good holiday season, and with all that is happening in the world, may we all look forward to a 1994 of peace for all the peoples of the world. **73**

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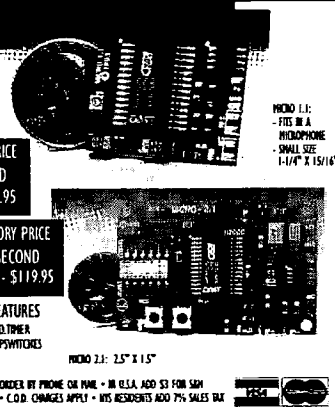


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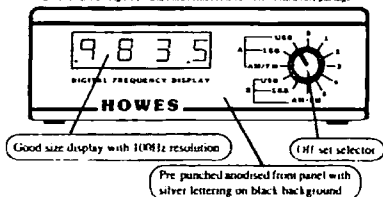
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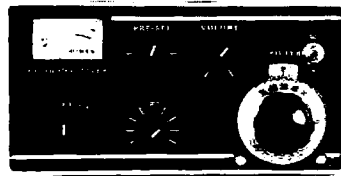
DRAWING: Showing DFD4 and PMB4 Kits in the new CA4M hardware package



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Building Small DC Power Supplies, Part 1

Hams and other electronic hobbyists often need small, low-voltage, low-current, DC power supplies. Most solid-state circuits require these power supplies. Indeed, if you look at solid-state circuits published in this magazine you will see that +5 VDC, +9 VDC and +12 VDC are the most commonly specified DC power supply voltages. We also see the same voltages in negative polarity used sometimes, as well as variable voltages (e.g. 0-12 VDC). Current ratings for this class of DC power supply vary from 100 mA to 5 amperes, with 1 ampere being by far the most commonly seen. This month we will take a look at how these DC power supplies are selected and designed. While DC power supply theory has gone far beyond the material presented here (watts/cu. in. are way up and lbs./watt are way down in commercial supplies), these supply circuits are easy to build with components that are available at almost any parts distributor (including Radio Shack).

Safety First

The DC power supplies described in this article operate from 115 VAC, i.e. residential wall current. There is an unfortunate and very stupid belief that this type of current is only moderately dangerous. Indeed, when I worked as a biomedical equipment technician in a major hospital, I overheard an intern claim that 115 volts from the wall isn't dangerous because they taught him in medical school that it's the current not the voltage that kills. I leaned over the

table and asked him if he'd passed high school physics on his way to an MD degree. Allowing, rather arrogantly that he had, I asked him if he'd ever heard of Ohm's Law. I then muttered to some people who were with me, "If he learned the rest of his medical school lessons the way he learned that one, will someone please shoot him on sight if he comes into the emergency room while I'm unconscious." The real fact is simple and brutal . . . so don't ever forget it: 115 VAC from the wall is potentially fatal. IT WILL KILL YOU if given a chance. A few guidelines will help:

1. Never work on a circuit that is plugged in.
2. Work on a dry, insulated flooring (I keep a masonite mat under my workbench stool).
3. Use a 1:1 isolation transformer to convert the one-side grounded AC power lines to a floating local power system.

I can't give you all of the information you need for safety under all circumstances, so please, please, please use some good sense when working with AC power.

The Basic LVLC Power Supply

Figure 1 shows the basic low voltage low current (LVLC) DC power supply sans switching and fusing. The basic components of the power supply are: transformer (T1), rectifier (BR1), ripple filter capacitor (C1) and a bleeder resistor (R1). We will take a look at other components, such as voltage regulators, later. But first, let's discuss the function of the basic components.

Transformer. The transformer (T1) serves to reduce the AC voltage from the power mains to a level required by the DC circuits to be served by the power supply. We will shortly discuss

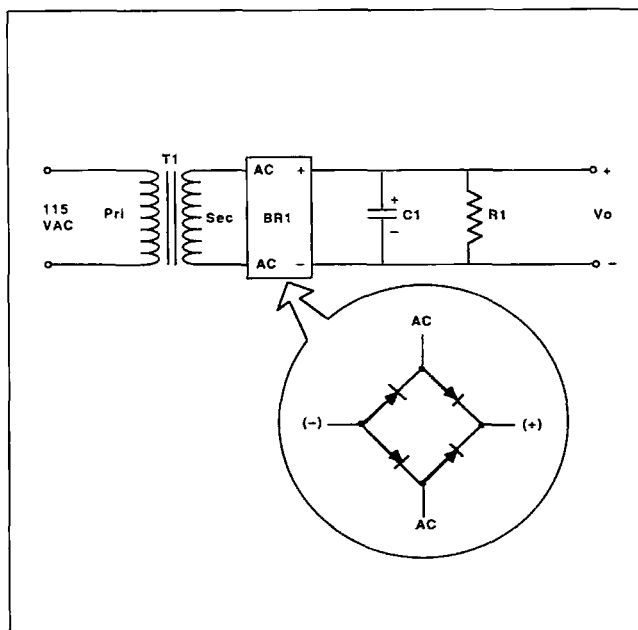


Figure 1. Basic full-wave rectified DC power supply.

what voltage and current ratings are needed for any given application.

Rectifier. The rectifier consists of diodes that convert bidirectional alternating current (Photo A) from the power mains to unidirectional pulsating DC (Photo B). There are two basic classes of pulsating DC: half-wave rectified and full-wave rectified. The half-wave rectified type only uses half of the AC input waveform, while the full-wave version (shown in Photo C) uses both halves of the AC waveform. Note that there are no spaces between the "humps" of the full-wave rectified version. In the half-wave rectified form there would be a flat line between humps representing the time taken by the rejected half wave. The output frequency of a half-wave rectifier equals the AC line frequency (e.g. 60 Hz in USA and Canada); the output frequency of the full-wave rectified pulsating DC is twice the line frequency (e.g. 120 Hz

in USA and Canada).

In Figure 1, a "bridge" rectifier is shown in the circuit. An inset shows the "innards" of the bridge rectifier, which is a ring of rectifier diodes.

Ripple filter. The pulsating DC from the rectifier is almost as useless to solid-state electronic circuits as AC. The ripple filter smooths the pulsating DC to make it much nearer to the pure kind-you-get-from-a-battery DC.

Bleeder resistor. The bleeder resistor serves two purposes. First, there is the issue of safety. Charged capacitors can be dangerous. While 12 VDC is not usually dangerous to intact humans, it can produce damage to circuits. In addition, if you wear a ring or watch or other jewelry, it is possible for the current stored in a large low-voltage capacitor to cause a nasty burn. Not likely, maybe, but life is full of nasty little "not-likely" surprises. The second use

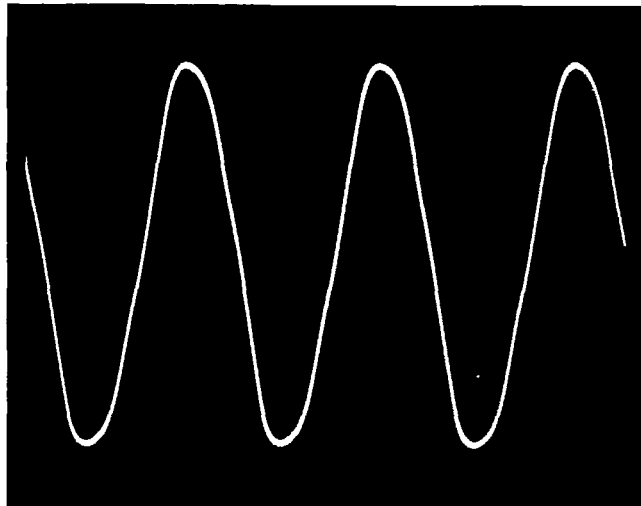


Photo A. The 60 Hz AC input to rectifier.

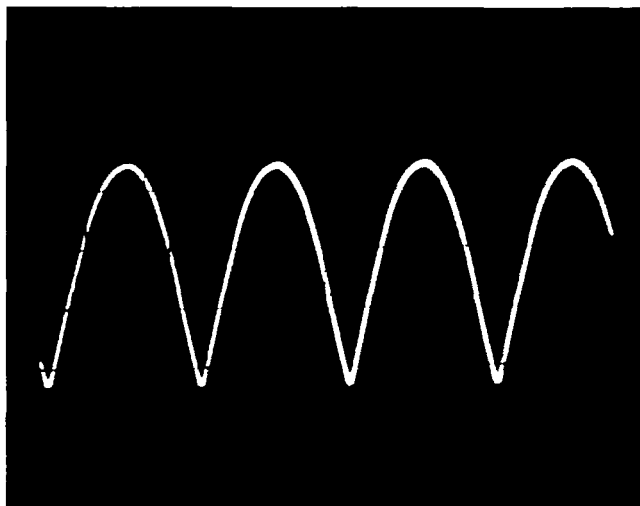


Photo B. Full-wave rectified pulsating DC output of rectifier.

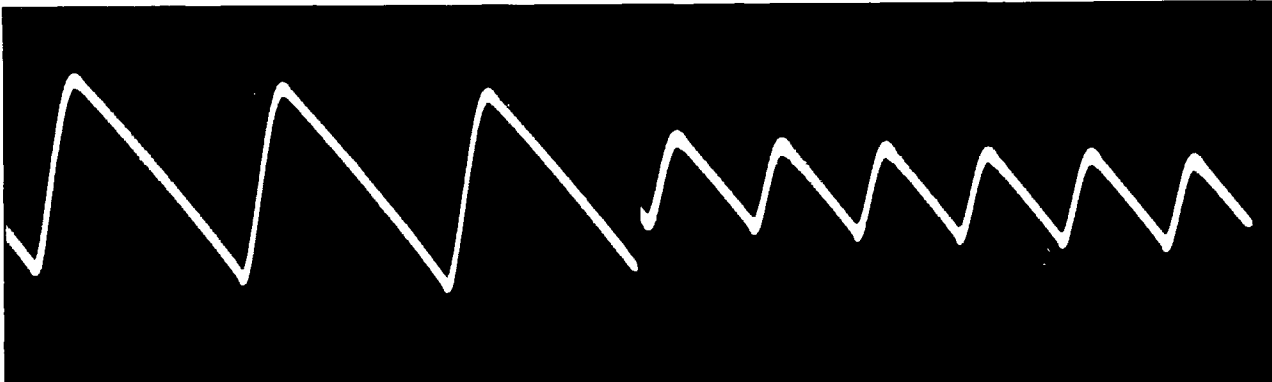


Photo C. a) Ripple with 100 μF filter; b) ripple with 1,000 μF filter.

for the resistor is to provide a minimal load to the rectifier. I've seen high-current low-voltage power supplies cause problems for marginally rated filter capacitors when the load was removed. It seemed that the pulsating DC peak voltage rose dramatically.

Component Ratings

The rectifier should be selected according to two ratings: peak inverse voltage (PIV), also called peak reverse voltage (PRV), and the forward current. The PIV rating is the highest reverse bias voltage that the diodes inside can tolerate without destruction. The general rule to follow is this: The minimum PIV rating should be greater than 2.83 times the RMS voltage rating of the transformer (T1) secondary winding. The reason for this value is that the diode will see the peak voltage from the transformer (1.414 Vrms), and this voltage charges the ripple filter capacitor (C1) to the same level. Thus, the reverse bias voltage seen by the rectifier is 2 X (1.414 Vrms), or about 2.83 Vrms. This minimum PIV rating is not usually a problem. Indeed, you can elimi-

nate the problem altogether if you use 1,000 volt PIV diodes or bridge rectifiers. If you go to most parts distributors, you will find 1,000 volt PIV ratings on most of the diodes available.

The transformer (T1) is selected to produce the required voltage. The average voltage across the filter capacitor after only a few cycles (milliseconds) will be about 0.9 times the peak voltage, or $VC1 = (0.9)(1.414)(V_{rms})$. Thus, a 12.6 VAC "filament" transformer will produce nearly 16 volts across the filter capacitor.

The current rating of the transformer secondary winding should be twice the expected maximum load current. For example, if you are building a 1 ampere DC power supply, then use a 2 ampere transformer. This guideline assumes that full-wave rectification is used. Many times I've violated this rule, and gotten away with it largely because the circuits I've built generally use a lot less than the maximum current. The maximum 1 ampere (1,000 mA) current drain usually only occurred briefly. However, 2 ampere transformers are easily available, so the guideline makes sense.

Also, if you violate the rule, check the transformer's operating temperature with the thumb test: Run the power supply for about five minutes, unplug it from the AC power mains (safety first!) and then quickly and gingerly touch the transformer's metal frame with your thumb. If it runs hot enough to burn then it's running at too high a current load.

The filter capacitor has two ratings to consider: capacitance and working voltage direct current (WVDC). The WVDC rating refers to the maximum voltage that the capacitor can tolerate on a continuous basis. I am generally quite conservative about this rating. First, assume a 20 percent tolerance: The minimum allowable WVDC rating should be 1.2 times the maximum pulsating DC that will be applied to it. I generally prefer a 2X margin, rather than 1.2 margin. Generally, whenever one sees a piece of equipment that has frequent problems with the filter capacitors "going west" it can be traced to using a supposedly safe but low margin of safety. In other words, for a power supply with a 12.6 volt transformer, which outputs about 16 volts peak, use a 25 VDC capacitor

at minimum, and prefer 35 WVDC and 50 WVDC models.

The capacitance required for the ripple filter depends on the degree of ripple suppression required, and the ripple frequency. The ripple frequency of half-wave rectified power supplies is 60 Hz in North America, so these require about twice the capacitance as full-wave rectified power supplies (120 Hz ripple frequency).

Photo Ca shows an AC-coupled (to eliminate DC offset) oscilloscope presentation of the ripple present on a lightly loaded 1 ampere 12 VDC power supply with a 100 μF filter capacitor (C1 in Figure 1). Without changing the settings of the oscilloscope, Photo Cb shows the same power supply, under the same conditions, when a 1,000 μF is used in place of the 100 μF capacitor. Note the substantial reduction of ripple.

In some cases, the ripple reduction of Photo Cb is good enough. However, there are many cases where a considerably better degree of ripple suppression is needed. Those cases require a voltage-regulated DC power supply... which is the subject of next month's column.

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UPDATES

Active Antenna Using a MOSFET by Ken Cornell W2IMB

Please refer to the above article in the March 1993 issue, page 32. The parts list correctly sets the values for RF chokes 1 and 2 at 1 millihenry; however, the schematic depicted them (incorrectly) as 1 microhenry RFCs. TNX to Victor Bennighl for spotting the mistake. The author makes another good point. He suggests that you set the R1 pot to its mid-point before applying power. (Adding a series resistor would provide an additional margin of safety for the MOSFET.)

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Testing the Ramsey Foxhound

You can tell that a ham radio activity is gaining popularity when established manufacturers begin to supply equipment for it. Until recently, hidden transmitter hunters (sometimes called foxhunters or T-hunters) had to build their own gear or buy it from a few companies specializing in radio direction finding (RDF) sets, such as Doppler Systems and BMG Engineering.

The big three manufacturers from JA-land aren't making T-hunt products yet, but at least one well-known US mail order company has begun to supply this growing market. Last winter's Ramsey Electronics catalog announced two new items of foxhunting gear. The "SlyFox" transmitter is still futureware as of this writing, but the DF-1 "Foxhound" direction finder is available at hamfests, from dealers, and by mail order from the factory (see Photo A).

A Versatile TDOA Set

Mobile VHF T-hunters usually use a Doppler unit with its ring of antennas, or the amplitude-based RDF method (beam, attenuator, and S-meter). In contrast, the Foxhound is a "homing" type of RDF set. Homing

RDFs have two vertical antennas—dipoles in this case—spaced less than a half wavelength apart, plus some sort of left-right indication (LEDs, meter, or tone pitch change).

There are two look-alike kinds of homing RDFs: switched cardioid pattern and time-difference-of-arrival (TDOA). Of the two, hams prefer TDOA units because they work with unmodified VHF-FM transceivers and do not require an RF attenuator at the receiver input. The DF-1 is a TDOA unit, similar in principle to a number of sets that have been developed since the early 1980s.

RF diodes in the Foxhound switch the receiver input rapidly back and forth between the two antennas at about 1 kHz (see Figure 1). When the incoming signal wavefront arrives at one antenna before the other (as for transmitters #1 and #3), the antenna switching produces pulses out of the receiver's FM discriminator, heard as a lone mixed with the received audio.

The phase of these pulses is detected within the DF-1 circuitry, activating the left or right indicator as appropriate. When the two antennas are equidistant from the source (as is transmitter #2 in Figure 1), no tone is heard and no LEDs light. A sharp null in the tone gives a precise line of bearing to the fox.

Using a homing RDF set is easy. Watch the indicators and listen to the

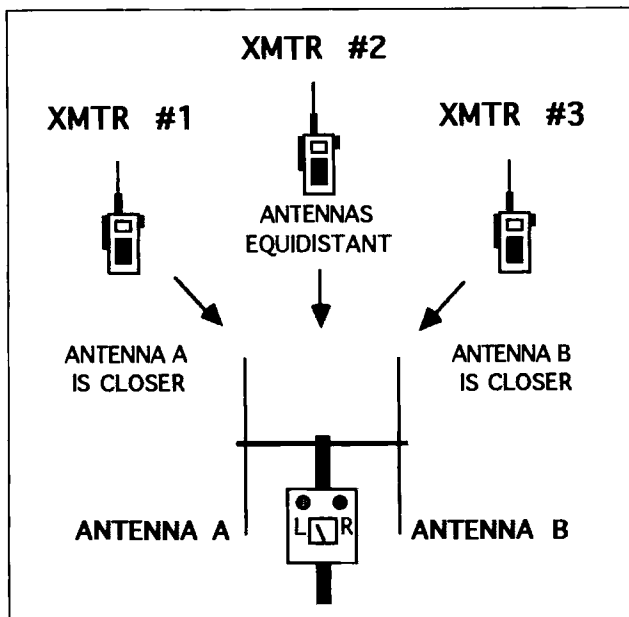


Figure 1. TDOA RDF sets such as the Ramsey Foxhound find direction by determining which of its two vertical antennas is closest to the transmitter.

RDF tone while you hold the unit and turn slowly. You should hear two distinct nulls in the RDF tone, 180 degrees apart. You are facing the direction of incoming signal when the tone is nulls and movement to the left makes the "turn right" indicator come on. Conversely, your movement to the right makes the "turn left" LED light. If the opposite happens, do an about-face and try again.

By walking, turning, and following the null and lights, you home in on the fox. The Foxhound is designed only for on-foot "sniffing." Using it in motion on a vehicle would be unsafe, unless you build a special rotating antenna system with extended coax lines so that the antenna pair is outside the vehicle and the rest is inside.

The DF-1's manual cover lines proclaim that it "works with any radio, any frequency." Not exactly. TDOA sets need carrier-type signals, such as CW or FM. They aren't designed to track SSB or broadband impulse noise. The receiver must have an FM detector. AM and product detector sets will not work with it.

The two TDOA antennas must be less than a free-space half-wavelength apart. The PVC-pipe-frame antenna pair described in the manual (23-inch spacing) is intended for 2 meters, but will work over a wide frequency range. You can use it with your extended-receive-range handheld or scanner to track signals in the business and maritime bands below 250 MHz. For higher bands, the dipoles must be shorter and closer.

Theoretically, the supplied whip set works on 6 meters, but the non-resonant antennas and short spacing results in too little DF tone from the receiver. A bigger antenna system is needed below 108 MHz. Portable

use of the DF-1 on 80-10 meters is not practical because an effective antenna set would be excessively large.

If At First...

The Model DF-1 kit (Photo B. Price \$59.95) includes a circuit board, all necessary components, meter, gain control, whip antennas, miniature coax, and instruction manual. You will need a case for physical protection and for meter and gain control mounting. The optional Model CDF case set (Photo C., \$12.95) includes a clamshell enclosure which is predrilled and lettered, plus all essential hardware.

An antenna framework is not provided. The manual shows how to make a frame for 2 meters from inexpensive PVC pipe and fittings. The whips mount on small circuit boards inside the pipe. (See Photo D.)

Ramsey supplied their Revision 1.0 kit for review. The circuit board was marked DF4 Rev 1.4 10/12/92. It took me one evening to populate the board and another to construct the antenna system. Aside from minor part discrepancies and some missing hardware, it went smoothly.

When I set up my test transmitter and powered up this early version, the performance was disappointing. Sometimes the meter would "hang" or bounce for no apparent reason. RDF indications were not trustworthy. The right indicator was on most of the time and the left indicator seldom came on.

Probing the DF-1 board with a scope showed clock noise and oscillation at the active tone filter output and on the Vcc lines. The favoring of one indicator appeared to be caused by asymmetry of the antenna switching waveform, which should be a



Photo A. Aha! It's in the trashcan! Jason McLaughlin KØBICZ shows how to "sniff" out a hidden 2 meter transmitter with the Ramsey Foxhound. The unit connects to the antenna and earphone jacks of his handie-talkie.

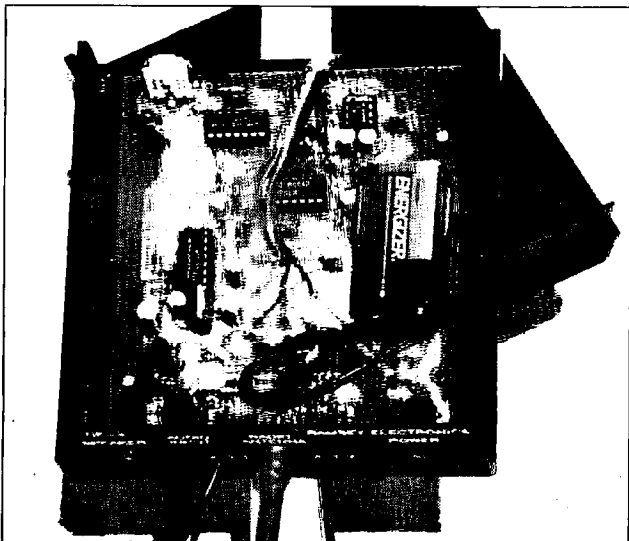


Photo B. The spacious circuit board is easy to assemble. For ease of troubleshooting, I used ribbon cable instead of the supplied short jumper wires to panel components. The Ramsey-recommended 9 volt battery is shown, but I later changed to 12 volt power.



Photo C. The DF-1 circuit board is designed to fit into the optional CDF plastic case. Coax and connector locations on the revised board are different from this original model. It's wise to order the case and board at the same time to be sure they are compatible.

50% square wave to minimize harmonics in the DF tone at the receiver output. A couple of electrolytic capacitors were installed according to the instructions, but were not observant of correct polarity for this circuit.

I suggested some circuit changes to Ramsey Electronics engineer Tom Hodge WA2YTM and he agreed to review the DF-1 design. A few weeks later, a Revision 1.3 kit arrived. Its new circuit board (DF1 Rev 2.0 5/13/93) had fixes to provide a square-wave switching waveform, better supply filtering, and proper capacitor polarity. Several glitches in the manual had been corrected and there were no missing parts.

After another session with the soldering iron (it went much faster the second time), the new board was ready to test. Now, with a fresh 9 volt battery, I was able to get good metering null and usable left-right indications with my test fox.

Raise the B+

The Foxhound uses a MF5 active filter IC, which is temperamental about its power source. When Vcc dropped from 9.5 to 7.8 volts after a few hours, it went into uncontrollable oscillation. Duracell specifies end-of-life of a standard MN1604 alkaline battery at 4.8 volts. Thus, much of the battery's capacity is wasted by replacing it at 7.8V.

I substituted a series pair of 6 volt Duracell 7K67 batteries in place of the MN1604 battery. These "J-size" batteries are widely sold for replacement in TV remote controls, etc. Each 7K67 has the same ampere-hour rating as an MN1604. Although DF-1's current drain is slightly higher at 12 volts than at 9 volts, the J's last much longer because they can be used to near end-of-life voltage.

Performance of the DF-1 is notice-

ably better on 12 volts, compared to 9 volts. The meter circuit is much more sensitive and the left-right indicators flicker less. I couldn't find holders for the J batteries and the tabs would not take solder, so I pried out the tabs, crimped them to stranded wires, and hooked the wires to the connector from an old 9V battery. Double-sticky foam tape holds the batteries to the board.

The Foxhound has a power jack on the bottom panel for external supply. If you don't mind another dangling wire, you can use it to supply 12 volts to the board. If you do this, be sure to remove all internal batteries. The steering diode in series with the battery was deleted when the board was revised. If you don't remove internal batteries, the external source will attempt to charge them with no current limiting. Damage to batteries or your supply could result.

Foxhound Pluses and Minuses

Most TDOA sets require you to listen carefully to the DF tone to detect the exact null. The DF-1 is the first set I have seen with a panel meter to help you find the null. Usually your ear is the best null detector, but the meter is useful when hunting in locations with lots of acoustic noise, or when there is heavy voice or tone modulation on the bunny's signal.

Plugging the DF-1's audio cable into your receiver disables its speaker. The only way to hear the hidden T and its tone null is to plug an earphone into a jack on the bottom of the DF-1. I don't like a tangling earphone cord when I'm tramping through the brush. Furthermore, the mini-jack supplied by Ramsey is the wrong size for my ICOM earplugs, so I added a 1-1/2-inch speaker inside the DF-1 case. The speaker is wired to the normally closed terminal on the

DF-1 earphone jack, so an earphone can still be used if desired.

With no audio from the radio, both LEDs are off. It's easy to forget to turn off the Foxhound's power after the hunt. To remind you to save the battery, you may wish to add an LED power-on indicator.

In Conclusion

The Foxhound adds sniffing capability to your RDF arsenal for less than 73 bucks. Its left-right LEDs give an unambiguous direction indication. The spacious circuit board is well documented to help you build and modify it to your particular needs. When powered by a 12 volt supply, its performance on 2 meters is comparable to competitive TDOA RDF sets for on-foot foxhunting.

If you already have an early model DF-1, I recommend upgrading it to the latest circuit for best performance. John Ramsey told me his company will provide modification instructions on request. Ramsey Electronics is at 793 Canning Parkway, Victor NY 14564; telephone: (716) 924-4560.

Remember that there are certain RDF situations where all TDOA units work poorly. Horizontally polarized signals are much more difficult to track than vertical, because signal reflections are enhanced relative to the direct signal on the vertical whips. Weak signals may be masked by noise from antenna switching. A properly polarized beam or quad is needed in those special situations.

Tracking in severe multipath (inside a building, for instance) is difficult with a TDOA, too. But when signals are strong, vertical, and in the clear, the TDOA will give sharper bearings than a beam, and bearings will be easy to get even if the fox transmitter is changing power.

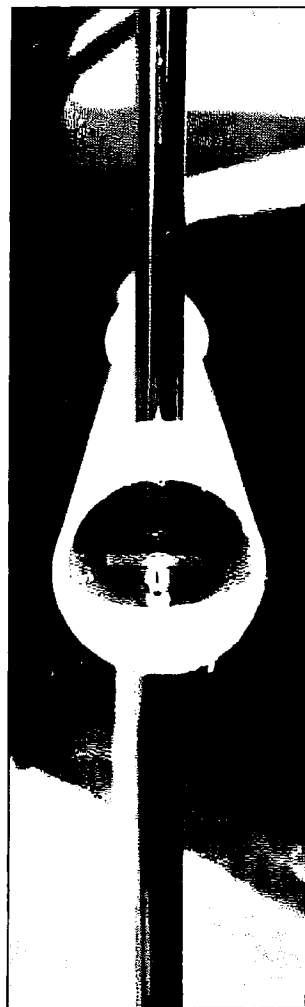


Photo D. A close-up end view of one antenna. Ramsey supplies the telescoping whips, small circuit boards to mount them, and miniature coax. You provide the PVC pipe frame.

HAMS WITH CLASS

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New Resources

At the beginning of every school year, I like to force myself to search out new resources to use in the classroom with my ham radio classes. There are lots of commercially prepared materials that are highly publicized that I use year after year to prepare the kids for the license exams. I realize, however, that it's important to continuously be on the lookout for new resources and new ideas.

With the delay of school opening in New York City due to the asbestos crisis, I've had time to peruse some wonderful new teaching aids and materials that I'll be adding to my program. In the spirit of sharing, I'll describe the new resources I'll be incorporating into my ham radio curriculum.

Alpha and Zulu

Riding The Airwaves With Alpha and Zulu by John Abbot K6YB is a delightful soft-covered book that uses comic book characters, the Phonetic

cos, to prepare you to take two different amateur radio license exams, the Novice and the No-Code Tech. One-hundred-and-twelve comic strips review all the questions and answers. If you look closely at the Phonetic characters you will notice that each one of their bodies is made up of Morse code "Dits" and "Dahs" that form the correct symbol for that character's letter.

After each cartoon page is a testing page. The answers may be found on the following page on the bottom left side. There are puzzles, connect the dots, word searches, games, and projects throughout the book.

This book will be a fine addition to any teacher's library. It retails for \$15 from Artsci, Inc., P.O. Box 1428, Burbank CA 91507; (818) 843-4080.

The Art of Science

If you're a teacher working with older or more advanced students you should take a look at a book called *The Art of Science* by Joe Carr K4IPV. This book is an excellent resource and guide for teachers and students alike that addresses the practical "how to do it" phase of scientific experimentation.

Joe discusses how to choose the

type of experiment best suited to your application, how to keep professional quality scientific records, how to make accurate measurements and correctly estimate errors, how to present your results like a "pro," how to think critically about your theories, and how to spot fallacies in the arguments of others.

For the serious students who participate in science fairs, there are valuable lessons in this book. Too often we forget to teach the basics of scientific inquiry and we neglect to give the students the tools they need to be creative yet exacting in their efforts.

The book is available from Hightext, P.O. Box 1489, Solana Beach CA 92075; (619) 793-4141.

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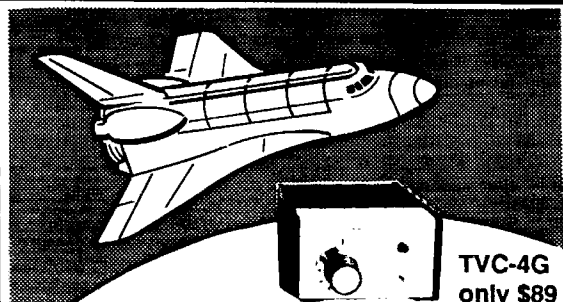
The ham radio students in my classes always enjoy working with Slow-Scan TV. John Langner WB2OSZ has a terrific package available for \$229.95. Pasokon TV is the interface, software, and manual, assembled and tested.

Here are some features: It can send and receive all popular modes. The interface fits inside the computer. It can



Photo A. John Abbot K6YB developed his *Riding the Airwaves* book from personal classroom experience at Los Feliz Elementary School in Hollywood, California.

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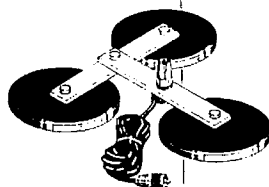
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Contact John for further details at 115 Stedman St. #M, Chelmsford MA 01824-1823; (508) 256-6907.

Cynthia Wall

Authoress Cynthia Wall KA7ITT was one of the guest speakers at a seminar I conducted at the Texas Hamcom last June. She spoke about the series of books she has written that are being sold through the ARRL. I was very pleased to have a chance to meet with her and to read her three terrific books. I see the potential for using them in the classroom.

tant it is for teachers to keep themselves stimulated with new and challenging materials in the classroom every term. You owe it to yourself as a professional, and you certainly owe it to your students, to utilize the latest techniques. So, avail yourself of new resources whenever possible.

One great place where teachers can meet to exchange ideas is on the CQ All Schools Net every Tuesday and Thursday at 17:30 UTC on 28.303 MHz. Listen up for net controls Carole WB2MGP, Gordon WB6NOA, and Jim N4MDC.

OWNERSHIP STATEMENT



Statement of Ownership, Management and Circulation

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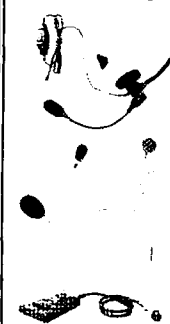
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Michael Bryce WB8VGE
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[Editor's Note: Observant readers of this column noticed last month's material was a repeat of the column originally printed in June 1992. We don't know how this happened. Michael passed in a new column but we somehow substituted an old one. We apologize to Michael and to his loyal readers.—Ed.]

Back to the Future

A transmitter's output must be as clean as possible. Just because it only produces 5 watts of output is no excuse for a dirty signal. That's the purpose of the output filter—to make sure the signal is clean. This month, I'll show you how to design an output filter for your latest creation.

Of course, the reason we need an output filter in the first place is simple: A transistor amplifier generates buckets full of harmonics. Without a properly designed filter, these harmonics would cause all sorts of problems to other stations and even other services. Unfiltered transmitters can produce interference to devices not in the amateur bands, such as your neighbor's TV, stereo, toaster, and so on. Never place a transmitter on the air without a harmonic filter!

The Output Filter

So then, the purpose of an output filter is to keep unwanted harmonics from ever reaching the antenna. We do this by designing a filter to cut off at a frequency just above the one we want to keep. In a 40 meter transmitter, the operating frequency is 7 MHz, of course. A good cutoff frequency for our output filter would be just above 7 MHz. Most output filters for the 40 meter band have a cutoff frequency of 8

MHz. Some may be lower, some may be a bit higher, but all will be around this range.

Frequencies under 8 MHz will be allowed to pass to the antenna. Those above the cutoff frequency will be attenuated. Depending on the type of filter, this attenuation may be as great as 60 dB. The amount of attenuation required is based on the amount of RF power too. A 5 watt transmitter is allowed a greater amount of harmonics than a transmitter running 100 watts. Get your rule book out and you'll see that transmitters under 5 watts are to have their harmonic contents under 30 dB down. A 100 watt transmitter must have its harmonic contents reduced to 40 dB down from the fundamental frequency. In either case, the larger the number in terms of dB, the better the filter works.

The amount of attenuation required will determine the type of filter required. In many simple QRP transmitters, a single coil and two capacitors comprise the output filter. The more sections you have in the filter's design, the better the filter. The amount of attenuation is measured as ripple. The less ripple, the better the filter. Ripple is measured in dB.

The Coils

In today's filter circuits the coils are almost entirely wound on toroid cores. Not only is a toroid self-shielding, it also allows a large amount of inductance in a very small package. You would be hard pressed to find a output filter in today's equipment not using some sort of toroid cores.

In filter design, we need to know several fundamental items: cutoff frequency, core type, input and output impedance, power handling capacity, and physical size.

Given a cutoff frequency in MHz, we need to first find the proper core to use

in our output filter. This is best done by looking up the core's characteristics on a chart or table. You can get one of these tables from any of the companies selling cores. The ARRL Handbook is also a good source.

As a good rule of thumb, a type 2 core is good from 80 meters to about 30 meters. Above 30 meters, a type 6 core is a good choice. I've seen some applications where a type 2 core was used for 20 meters and type 6 material on 30 meters.

Don't be duped into thinking the color of the core is etched in glass. I've been bitten by this bug before. Just because the core is yellow, don't assume it is type 6 material. Be especially careful of hamfest or surplus toroid cores. A mislabeled core in your next rig could be a hard problem to track down.

The amount of inductance required will also dictate the required core. There are two more factors that need to be addressed: wire size and, to a certain extent, output power.

I have found that wire size has little to do with the final inductance of a coil wound on a core. Before I get hate mail from Mike WA8, let me say most hams don't have the specialized equipment to measure the exact inductance of a homemade coil. If the plans call for 24 turns of number 26 gauge wire but all you have in your junk box is 24 gauge, then use it. You won't be able to tell any difference in the final output of your project.

On the other hand, if the coil needs to be wound with six turns of number 12 gauge wire, you can't really substitute six turns of number 22 gauge wire either. Most high-power (high-current) applications will require a thicker gauge of wire to handle the current flow, be it RF or DC. The core size and type will also have to be determined to handle the power at the required inductance. A larger core will be required to hold larger wire to get the same amount of turns required.

Inductance Values

Output filters of 0.01 dB of ripple

have become somewhat standard with QRP transmitters. A better filter would have 0.1 dB of ripple. You'll see about a two percent loss in power, but you'll gain a 10 dB improvement in attenuation.

The desired filter frequency will be: $F_c = F_o (1.15)$. Use 7.2 MHz for F_o : $F_c = 7.2 \times 1.15 = 8.25$ MHz. The filter cutoff frequency (F_c) is 8.25 MHz.

From the chart, for a 0.1 dB ripple, seven-pole filter, the value for L_1 is 11.32. So, $L_1 - L_3 = 11.32 / 8.25 = 1.35$ μ H.

From the same chart, the value for $L_2 = 12.52$. So... $L_2 = 12.52 / 8.25 = 1.5$ μ H.

This tells us the required amount of inductance for each of the coils in our transmitter. The number of turns will be calculated next, but first we have to see what type of core we'll use.

I happen to have a handful of T-50-2 cores, so that's what I'll use. According to the table supplied by Amidon, a 2 mix core is good from 1 to 30 MHz. This same table provides us with an important factor required for calculating the number of turns: the AL value. This tells you the μ H per 100 turns of wire on the core. The AL value for the T-50-2 core is 50.

$$\text{So, turns required} = \frac{100 \sqrt{\text{desired } L (\mu\text{H})}}{\text{AL value.}}$$

$$L_1 - L_3 = 100 \sqrt{\frac{1.35}{50}}$$

L_1 and L_3 require 16 turns of wire.

$$L_2 = 100 \sqrt{\frac{1.5}{50}}$$

L_2 requires 15 turns of wire.

Capacitor Values

This takes care of the coils. Now for the capacitors required in the filter. Again from the table, C_1 and $C_4 = 3759.8$. $C_1 - C_4 = 3759.8 / 8.28$. C_1 and C_4 are 454 pF; use the standard value of 470 pF.

$C_2 - C_3 = 6673.9 / 8.28$. C_2 and C_3 are 806 pF; use the next standard value of 820 pF.

By using the information available to us, we can calculate the values required to keep our transmitters clean. Give the old calculator a try and create your own QRP machine.

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Getting Started with TCP/IP, Part 3

Wow! I guess you ARE interested in getting a TCP/IP station on the air. At least that is the way it looks from here. I have received *hundreds* of email requests for information about software and IP addresses. My Internet mailbox overflowed, so I lost some of the queries, and I just couldn't possibly answer all those requests—not enough time in the day. So, I'll do the best I can, and try to clear up the confusion that a transposition of letters caused in the first installment of this series, and give you the best information that I have about IP address coordinators.

In the first column I told you to get a copy of JNOS version 1.08c from UCSD.EDU via anonymous FTP. Well, forget that. Here is the CORRECT information:

Location: UCSD.EDU (note the correction from UCSD.EDU)

Directory: hamradio/packet/tcpip/wg7j

Filename: JNOS107B.EXE

Those of you who have managed to get later versions of JNOS, this is fine. The choice of 1.07b is based on its stability and availability, but later versions will work. Keep this in mind because this version is available in the directory noted above. The 1.07b version will be available on the 73 BBS, in the "Packet and Computers" area (8). You can reach the 73 BBS at (603) 924-9343, 2400 baud, 8N1. Note that this is a relatively large file and the slow speed of the 73 BBS should convince you to try other places first.

Uncoordinated Coordination

I thought most of you would be able to find your local AMPR coordinator, though I expected a few requests for help. Well, after receiving hundreds of messages via Internet mail, I realized that maybe some of you were having some trouble. I have to do something, but answering each of your cries for help is not a practical

route. So, here (in the sidebar) is the list of the official volunteer AMPR coordinators. THIS IS ALL THE INFORMATION THAT I HAVE. I cannot tell you how to contact these people or exactly which one is the coordinator for your location.

Look on the list and take your best shot. It has been sorted by location, to make it easier for you. Also, the last column is the *subnet* for the coordinator's area. This can also be a clue for you. Find someone with an IP address and look for the matching subnet. Remember that these people are volunteers—please be friendly and courteous with your request. If you think that you might want to run more than one station, request more than one address. Though the specific information that the coordinator will need may vary from place to place, if you contact them via packet radio, try to include at least the stuff below to decrease your chance of being asked to provide more information:

Your name.

Your call.

A mailing address.

A phone number.

The county, town or city, and zip code where the station will be located.

You may have to wait a little while for a reply, try to be patient. If you want to get started, but don't yet have an address, you can use the official "test" network. This is any address in the 44.128.XXX.XXX range.

An Important Note About Packet Radio

While I always enjoy corresponding with you via packet radio, I simply cannot do business that way. Because I do not want to have even the appearance of impropriety, I just cannot answer any mail that refers to the column and then asks for help. Please, if you need help, use commercial email or paper mail. I can be reached on the Internet:

jsloman@bix.com

and by US mail:

N1EWO

P.O. BOX 636

Franklin IN 46131

Thanks for your understanding.

Note, too, that I still want to hear from

you on the amateur packet network. Please, just restrict this traffic to pleasantries or questions that relate to ham stuff with no reference to the column.

More Than Error Correction

Though I had planned to get started on the tutorial this month, I had to clear up the confusion caused by typos and whatnot. Now I don't want to completely frustrate those of you who have managed to get the software and an IP address, so let's take what space is left to at least begin the tutorial. (Next month will be dedicated to the tutorial.)

JNOS and Its Files

The heart of making JNOS work is a set of text files that configure the program and provide information to it. Though they all must be in good shape for things to work, the central focus is on a configuration file called AUTOEXEC.NOS. Like a combination of DOS' CONFIG.SYS and AUTOEXEC.BAT, AUTOEXEC.NOS contains hardware and software configuration information and commands for the program to carry out on start-up. It is the arcane and not-so-logical stuff in this file that will make or break your station.

Unfortunately, the exact format and syntax of AUTOEXEC.NOS varies not only among implementations of NOS, but even among versions of the SAME implementation. To get you started with JNOS, we'll look at one of the most confusing and absolutely required sections of AUTOEXEC.NOS as it works with JNOS (and most other NOSs, thank goodness).

The section is reproduced here in Figure 1. These are the statement(s) that attach the communication device(s) to the program. Our example here is to connect a TNC to a comm port. Later on we'll look at more advanced stuff like Ethernet.

Any of the lines that begin with "#" are comments, and shown are lines for all four comm ports. The active one is com1, since it is not

preceded by "#".

The attach command instructs the program to connect a hardware device to the program. The parameter "asy" is an abbreviation for "asynchronous," the type of communications device. The next value "0x3f8" is the base address of the communications port, you probably don't need to change the values from the standard ones listed here. Following the base address is the IRQ (interrupt). This is also a standard value for each port. The next parameter, "AX25," tells JNOS what sort of interface this will be. There are other values which we will discuss later.

The value "tnc0" is an arbitrary name that is used to refer to the interface you are creating. This name can be nearly anything, and should probably NOT be tnc0. Many users name it by frequency—01, 03, 05, etc.—to make it easier to understand what is going on. If your station will not necessarily stay on one frequency, name it anything that seems meaningful to you.

The next two numbers are buffers; don't change these until you know more. This is another advanced topic which we will discuss. The last number is the baud rate of the port. Note that it is set to 4800 here. Why? Because the program may have difficulty decoding the information from the TNC if it comes at a higher rate, but the messages from the TNC will seem intolerably slow at 1200 or 2400. This is a good compromise. One way to tell if you have the port speed set too high is the presence of corrupted or "nonsense" calls in the "just heard" list.

Keep It Simple, Stupid

The other absolute requirement for NOS to operate is that the TNC be made to operate in KISS (Keep It Simple, Stupid) mode. In this mode, JNOS takes over the operation of the TNC. There is a small script included as part of the AUTOEXEC.NOS that is designed to turn your TNC's KISS mode on (most TNC command sets require a simple "KISS ON" com-

```
# -----ATTACH THE TNC-----
attach asy 0x3f8 4 ax25 tnc0 2048 256 4800 # COM1
# attach asy 0x2f8 3 ax25 tnc0 2048 256 4800 # COM2
# attach asy 0x3e8 4 ax25 tnc0 2048 256 4800 # COM3
# attach asy 0x2e8 3 ax25 tnc0 2048 256 4800 # COM4
```

Figure 1. One of the critical sections of AUTOEXEC.NOS.

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North Carolina (East)	Ken Stritzel	WA9AEK	44.072	John	Thailand	HS1JC	44.159
North Carolina (West)	Chuck Henderson	WB9UUS	44.073	Emy Tontlinger	South Africa	ZS6BHD	44.16
Texas: South	James Curran	KA4QJN	44.074	C. Costis	Luxembourg	LX1YZ	44.161
Texas: West	Charles Layno	WB4WOR	44.075	Chuck Hast	Cyprus	5B4TX	44.162
Oklahoma	Kurt Freiburger	WB5BBW	44.076	Otto Morroy	Central America	T13DJT	44.163
Pennsylvania: Eastern	Rod Huckabay	KA5EJX	44.077	Andrzej K. Brandt	Surinam	PZ2AC	44.164
Montana/Steven Elwood	Joe Buswell	K5JB	44.078		Poland	SP5WCA	44.165
Colorado: Western	Doug Crompton	WA3DSP	44.08	"Lakshman ('Lucky') Bijanki"	Korea	Unknown	44.166
Wyoming	N7GXP	44.082		Bolon	India	VU2LBW	44.167
Connecticut	Bob Ludtke	K9MWM	44.084	Kunle	Taiwan	BV5AF	44.168
Nebraska	Reid Fletcher	WB7CJO	44.086	Sinisa Novosel	Nigeria	5N0OBA	44.169
"Wisconsin, Upper Peninsula Michigan"	Jon Bloom	KE3Z	44.088		Croatia	??	44.17
Minnesota	Mike Nickolaus	NF0N	44.09	Ekendra	Serbia	??	44.171
(Minn-Twin Cities area only)	Pat Davis	KD9UU	44.092	(no one has volunteered yet)	Sri Lanka	4S7EF	44.172
District of Columbia	Gary Sharp	WD0HEB	44.094	Luiz F. Catalan	Mexico	XE??	44.173
Florida	Andy Warner	N0REN	—	Jose Amador	Brazil	PP5AQ	44.174
Alabama	Don Bennett	K4NGC	44.096	Abdul-Hamid Sadka	Cuba	CO2JA	44.175
Michigan (Lower Peninsula)	Bruce La Pointe	WD4HIM	44.098	Karel Odehnal	Turkey	TA2LA	44.176
	Richard Elling	KB4HB	44.1	Karen Tadewosyan	Czech Republic	OK2XTE	44.177
	Jeff King	WB8WKA	44.102	Tom Clark	Russia	RA3APW	44.178
					Outer Space	W3IWI	44.193

mand). We will cover this part of the file next month. In the meantime, if the TNC does not seem to initialize correctly try this: Talk to the TNC with

any communications program, ensuring that the communications speed (baud rate) matches the one you chose in the AUTOEXEC.NOS.

Check your manual for how to get your TNC into KISS mode. Send the command(s) and exit the program. Start NOS, and you should be all set.

Next time we'll get into more meaty stuff. Sorry for the confusion—I hope it's cleared up now. 'Til then 73 de N1EWO.

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Super Portable ATV Repeater

One night while I was visiting with Mike Henkoski KC6CCC, we decided to try to build a lightweight ATV repeater with a minimum number of components. The idea was to come up with a compact battery-operated system that could be easily transported (or even backpacked) to a remote site to act as a temporary relay during a special event or emergency. To test it out in the field we chose to launch it into the stratosphere with a weather balloon. From our planned maximum altitude of 100,000 feet we could potentially link up two ATV stations that were 800 miles apart (provided the repeater was midway between them).

The System

In order to eliminate the filtering and shielding required of an in-band repeater, we went with a crossband system that received on 915 MHz and transmitted on 434 MHz (see Figure 1). Mike KC6CCC designed a homebrew receiver taken from a commercial surveillance system that provided us with a complete receive board on 915 MHz that outputted video and au-

dio directly. Note that you could also use a crystal-controlled receive board with a companion IF strip available from P.C. Electronics for this part of the repeater.

The transmitter consisted of a P.C. Electronics 80 milliwatt micro-ATV board (with companion subcarrier strip) which drove a PA5 power amplifier module. This combination gave us a 5 watt sync tip output while only drawing a little over 1 amp of current.

The repeater ID consisted of an Eltronics VDG-1 with an external timer. It would be better to go with a video-operated relay (eg: a VOR-2) instead of the timer, but we used what we had in the shack at the moment.

To keep the total repeater as light as possible, we used five D-cell lithium batteries (7.5 Ah). Although usually very pricey, we found a good source of very reasonably priced surplus lithium packs (10 D-cells) from S&G Photographic, telephone: (215) 474-7663. One pack should give you around 10 hours of operation (five hours using just five cells). Where weight is not critical, you will probably want to use a 5 Ah rechargeable gell-cell pack.

Mike KC6CCC built a pair of quadrifilar helix antennas (one for each band) for our flight test since we wanted a good pattern below the balloon repeater. For a hilltop or remote site, you will probably want to go with



Photo A. Mike KC6CCC, Mike WA6SVT, and Curt N6TWB fill three balloons to lift the ATV repeater.

a linearly polarized omni or gain antenna system, depending on the area you want to link up.

The Flight Test

About 24 hours after tossing the potential repeater components into a big pile, we had the ATV repeater wired up and mounted in a lightweight styrofoam package. The modules were fastened to a piece of foamcore and surrounded with one-inch-thick styrofoam for insulation. We powered up the repeater and discovered that the transmitter section was badly overloading the receiver board. Fortunately, Mike Collis WA6SVT arrived on the scene and went to work bypassing the power leads while Mike KC6CCC shielded the receiver with

copper foil. After spacing the antennas about five feet apart (the 434 MHz helix dangled below the payload), we finally came up with a fully functional crossband ATV repeater that performed well. The entire repeater (complete with batteries) weighed in at a mere six pounds!

We loaded everything up and headed for the hills above KC6CCC's house in San Clemente. We decided to launch the repeater with three small weather balloons. As Mike WA6SVT held onto the repeater, the balloons whipped about in a strong 10-15 knot wind. The possibility of crashing the repeater into the ground at takeoff was very real. Mike solved the problem by walking over to the edge of a cliff and tossing the re-

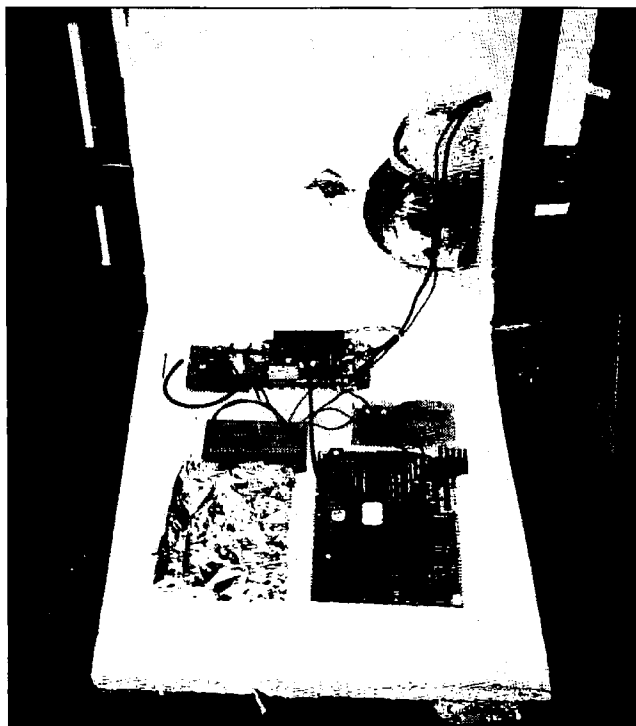


Photo B. The completed ATV repeater next to its styrofoam enclosure.

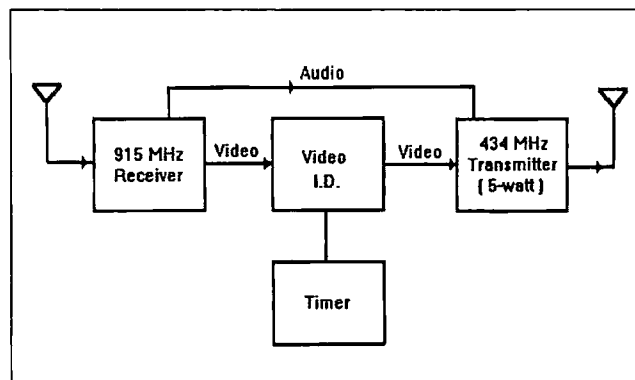


Figure 1. Block diagram of the lightweight ATV repeater system.

peater over the side! Just like taking off in a hang glider, the balloon repeater headed slowly off to the edge of space.

The 5 watt transmitter power provided most stations within 100 miles of the repeater with P5 color reception throughout the three-hour flight. Two stations in the area were capable of transmitting up to the repeater on 915 MHz during our flight test. We were able to send color video through the repeater from the launch site when we had our antennas oriented properly and Sam Lutweiler K6VLM could access the repeater with P2-P5 signal levels from his location in La Mirada (about 50 miles to the north). He could even repeat through the system using just 1 watt of uplink power.

It was such a clear day that we were able to see the balloons with binoculars and even observed two of them bursting at 72,000 feet. The repeater started descending with one

balloon still intact and landed near the top of Mt. Elsinore near a dirt bike park.

Curt N6TWB and Jon N6ZYX Toumanian were chasing the repeater with DF gear and quickly spotted the remaining balloon bobbing above the repeater as it rested on a ridge about a mile ahead of them. As they rounded a curve and arrived at the landing site, they were surprised to see that the balloon and repeater had disappeared. They walked past some nearby pickup trucks at the dirt bike park and heard a strangely familiar beeping sound coming from the back of one of the trucks. It turned out that one of the dirt bikers, Tom Vetter, had beaten the chase team to the repeater and was about to call us for the reward! Although our wallets were a little thinner, we did recover the repeater. The repeater survived the flight in excellent condition and we hope to fly it again soon to test it out with different combi-



Photo C. Sam K6VLM's 1 watt signal, as seen via the airborne repeater.

nations of in and out frequencies. For example, a future flight may use 434 MHz in with either 919.25 or 1253.25 MHz as the output.

73

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Microwave Waveguide Construction: Detector Mounts and Transitions

This month I would like to pass on information about constructing microwave waveguide components. I want to cover diode detector transitions and other bits and pieces, in response to several questions. Where can you find these? The answer is they can be found at swap meets and such. If you can't find them, you can construct them at home out of very junky waveguide scrap, with just a little effort. The construction doesn't require close tolerance work; suitable devices can be constructed in any home workshop. The units you construct should have a usable frequency span of an octave or more.

The best waveguide to select for construction is brass because it can be soldered with a heavy soldering iron (300W or so), or even a small torch is OK. Aluminum can be used,

despite the fact that it cannot be soldered without special fluxes. This can be done, but I feel that it's not very effective. I don't use the special aluminum soldering fluxes. They are costly, and my experience with them has given poor results. Let's get on with the construction and remove the veil of secrecy from these useful microwave components.

Finding Waveguide

Where do you get material for this construction project? Well, waveguide can be purchased new from suppliers at nearly \$4 a foot, but most suppliers have a minimum order value far in excess of what you are probably willing to spend, pretty much removing that source from our list. What I prefer to do to remedy this situation and to keep prices low is to select some scrap sections of used waveguide at swap meets. These can be part of an attenuator or other obscure Old World test or filter section. These waveguide pieces can best be described as a short section of guide with something in the middle of the section that is not desirable and would make good doorstep materi-

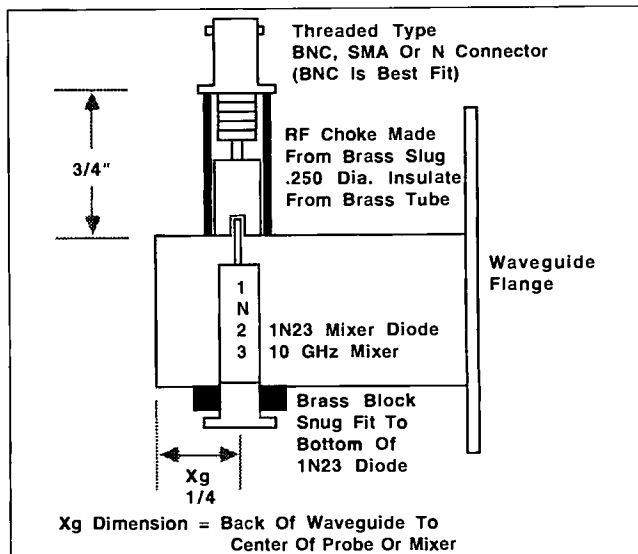


Figure 1. Waveguide mixer construction. Brass tube: size to fit BNC connector. Brass choke: 0.250" long, with hole to fit 1N23 diode, and other end soldered to connector. Insulate from brass tube with Scotch tape. Ground the diode's bottom end in the brass block. The dimension for Xg is 1/4 wavelength, modified by the velocity change in waveguide, or (Xg). The length is 1/4 Xg. For further data, see the BASIC program in the sidebar to compute Xg.

al. The modification is to cut off the middle section and toss it into the junk box or scrap metal box.

The more obscure the guide section looks, the more inexpensive the

part will be. I always try to locate something in the surplus market that was bent into something special, with an appearance more like a pile of worms than waveguide. The reason

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for picking up these obscure sections of waveguide is simple: We only want the flange end and about an inch of waveguide behind it for our applications. The rest can be junked. Usually these special bent pieces will yield two flanges and short sections of guide. That's all we need to construct either a detector mount or a transition to coaxial connectors for our use. In these applications we can use SMA, BNC, or even type N coaxial connectors.

Any connector can be used; the important point is where the coaxial connector's pin is located in the waveguide in respect to the shorted rear end of the guide. Basically, the detector mount construction is almost the same as for a transition. The detector mount difference is due to the diode decoupling capacitance. In this way it varies from the transition, which does not require any decoupling. Whichever unit you construct, the design principles are the same.

Let's start with a detector mount construction and its capacitance decoupling. To obtain this output capacitance for the diode detector, a small circular tower (pipe) is built on top of the waveguide to accommodate this capacitor. The capacitor is constructed out of a solid piece of brass round stock that is cut to size, allowing a fit when insulated inside the tower pipe. This makes it an RF short at microwave levels, hence it is an RF

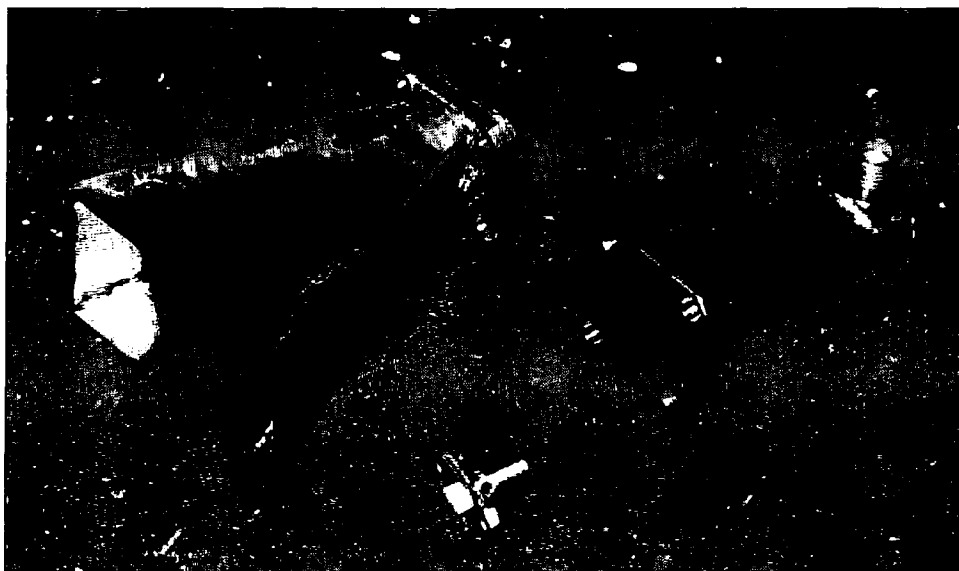


Photo 'A. Example of a homemade horn constructed from PC board and a transition for 24 GHz. Note the small coax connector center for size comparisons. Photo by WA5VJB.

choke. Together with the diode mounted in the waveguide, this tower connects with the business end of the diode and connects it to the coaxial connector for easy use. The RFC (brass rod) decouples the RF at microwave frequencies, giving good isolation from the waveguide RF to de-

tor output at low frequency RF, usually 145 MHz. The RFC is not apparent at 145 MHz.

Well now, how about a little boring math? This is needed to construct these devices for your desired frequency or different waveguide type. This formula is good not only on 10

GHz but also on almost any frequency for which you have a section of waveguide, even 24 GHz. The calculations are needed to determine where to position the diode or coaxial probe. The computer program in the sidebar gives the required spacing needed for proper operation. I have made the pro-

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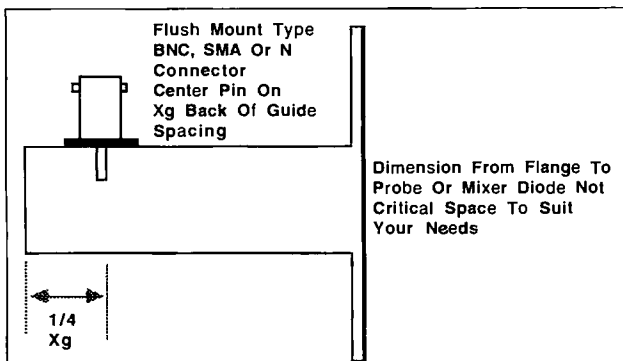


Figure 2. Waveguide transition construction. Solder the coax connector direct through the mounting hole in the top of the waveguide. The pin on the connector should be 0.1" long for 24 GHz and 0.2" long for 10 GHz. SMA center pin diameter is OK for 24 GHz; for 10 GHz the diameter of the pin should be 0.050".

gram short and easy to use—no frills here.

The calculations depend on just what type of waveguide you are using and what frequency you wish to optimize your device for. Table 1 includes some of the more popular waveguide types and lists both their "WR" number and the older equivalent "WG" number. To match waveguide up I have also included the guides' inner and outer dimensions so you can compare the guide you have to the table for identification. Normally, for 10 GHz WG-16 is used, but WG-17 can also

be used. As a matter of fact, you can mix sections of both WG-16 and WG-17 without much extra loss; this works reasonably well. Just bolt up as best you can with the smaller waveguide centered about the larger waveguide's opening and drill the larger guide bolt holes to match the smaller bolt pattern. Then connect them up.

I don't mean to say that you can use several conversions between two points, but rather that in a line of, say, WG-16 you can terminate the end in WG-17 with little change in loss compared to a proper termination. We

have observed additional losses in the 0.4 dB range for this adapting. Not much of a price to pay for making something usable. See Table 1 for dimensions for your frequency selection. XG is the dimension for a guide wavelength, which is shorter than free-space wavelength.

Computing Guide Wavelengths

The guide wavelength program (see sidebar) in BASIC requires only the broad width of the waveguide and the frequency of operation to compute the guide wavelength. Guide wavelength is different from free-space wavelength and must be accounted for. "X" is calculated for free-space wavelength at sea level and some humidity is entered into the calculation. It uses a fudge factor instead of using the more familiar 300,000 figure. The guide wavelength is then divided by 4 (step 84) and this is the quarter-wavelength dimension needed for the probe or diode placement in your selected waveguide. The probe is centered about this dimension from the rear inside point of the waveguide in both applications.

Now for some practical applications in the real world. If you go and check these calculations out against existing transitions and mixer diode mounts that you might have, I hesitate to tell you, but there will be some glaring errors. Primarily, the errors in sizing will

happen because the part being measured was designed for some other frequency that we are not aware of. When we think of material being suitable for 10 GHz, remember that some of the commercial equipment was designed for use at 12 GHz and this could be part of the error observed in the calculations. Any other errors can be attributed to the free service that I offer, and will be taken in the same regard. To place a "forgiveness" factor in any calculations you could make the rear wall a little longer and place a solid metal plug to fill the inner waveguide dimensions. Adjusting this metallic plug will allow any error in assembly to be effectively adjusted out of the unit. It requires more construction but is a fine-tuning method.

Construction Details

Actual constructed mounts are depicted in Figure 1 for the transition and Figure 2 for the waveguide mixer mount. I think it has been shown that being off a few thousands will not have much effect on the quality of your mount. However, when you construct anything with waveguide, having any material like solder inside the guide will have a detrimental effect and will increase the device's loss. These materials include various solders and fluxes, water, any obvious metal particles, or burrs on the edges. The mating flanges can be commer-

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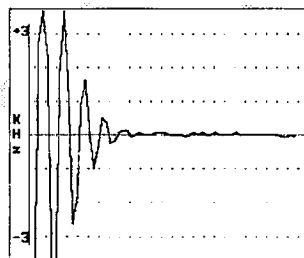
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CIRCLE 248 ON READER SERVICE CARD

cial or homemade, and should be flat to mate well with each other.

The only trick with old flanges or home-brew flanges is to make sure that the surfaces are flat. To be sure, lightly file any rough edges to approximately flat. Then place a sheet of light grade emery or sandpaper on a small section of junk glass. Sand the flange and waveguide with the flange face-down on top of the glass plate. Sand flat on the sandpaper/glass, moving with a circular motion. In this way you will guarantee that the flatness of the glass sanding table will be transferred to the waveguide flange. After a few passes on this sanding table it will be obvious how well this method works. The high and low spots are very evident on the sanding just completed. When the flange is uniform in appearance, it is flat.

Well, that's it for transitions. The main point is: Don't let junky-looking waveguide remain in the scrap heap. Even the most worry-looking section can be put to use if it has a one- or two-inch straight section. The coaxial part of the probe should enter the waveguide about half of the waveguide's small dimension for good coupling. SMA connectors have quite small probes. In this case, build it out with a small brass tube about 1/16 inch in diameter to make the probe wider. Remember, dimensions can be very forgiving. High accuracy is not required in construction. A milling machine is not required.

Mailbox

Raymond Clancy of Westminster, California, writes, "Where can I locate surplus LNAs to convert, as per your May '93 column?"

Well, Raymond, that's the paradoxical question, as they are where you find them. I have responded to several newspaper advertisements for satellite service and have had lots of rejections, but one strike. I believe this method could be tried in almost any city to attempt to locate some used

LNAs. These are not much use to commercial dealers; these dealers should be your best bet. Some dealers don't want to talk about used units, they'd rather do a sales pitch on new systems. I guess some business owners don't want to redistribute used material, perhaps because they fear competition for new sales. In this case stress that the units will be torn apart and that they are not going back into satellite service, but into amateur radio service instead.

Some shops will hustle you for a high price, without knowing the LNA's condition, presumably because they are still trying to sell you a new unit. You just have to get by that barrier. For the time being, since you are located in the Los Angeles area, I would suggest you go to the swap meets, particularly at TRW, which is in the Los Angeles area. Cost for most units as is should be no more than \$5. That's the typical price I have found for swap meet units. And don't overlook the local non-ham swap meets—there are a lot of people getting rid of their satellite systems. The bottom line is that if the asking price for an old 80-to-100-degree LNA is over \$5, they're asking too much. That is, unless the unit is new, from stock, and never used. I paid \$25 for my first LNA and \$35 for the first 12 GHz LNB. What a price to pay for education.

Mark WOPMX wants information on the Mitsubishi M57716. I looked at my reference material and could not come up with the data. RF Parts Co., a 73 advertiser, lists many of the modules for sale, but not the M57716. What Mark needs is the pinout information and spec sheet for the device. Does anyone out there have the information for him? He is at 4810 Indiana St., Golden CO 80403. I am sending off to Mitsubishi for data on their modules, and I hope to get back to you soon with data.

Well, as I write this column I am getting ready for the last weekend of the ARRL 10 GHz contest. The plan

TABLE 1.

WR #	WG #	OD-inch	ID-inch	Freq. GHz
WR-90	16	1.0 X .5	.9 X .4	8 - 12.4
WR-75	17		.75 X .375	10 - 15
WR-42	20	.5 X .250	.420 X .170	18 - 26
WR-34	21	.420 X .250	.340 X .170	22 - 33

Figures for WG-16 (8 TO 12.4 GHz):

Frequency	10000	10050	10368	10500	MHz
XG=	29.978	29.828	28.914	28.550	MM
XG=	39.703	39.359	37.320	36.553	MM

Figures for WR-42 (18 TO 26 GHz):

Frequency	24000	24193	24240	MHz
XG=	12.491	12.391	12.362	MM
XG=	15.407	15.221	15.167	MM

Formula to figure your own:

Xg = Guide Wavelength

Xg = $X / \sqrt{(X/2a)^2}$ where X = wavelength in MM and

a = Guide ID width (WG-16 = .9 inch)

this month is to operate near our local area and get as much activity up and running as possible. I will be operating SSB with 10 watts power output to a 30-inch dish. I plan to bring my older system, a wideband FM unit, to be able to work those stations using wideband. This year N6IZW and I plan to test a video system with our narrow-band rigs on 10 GHz. W6VLF and N6OYJ plan to do similar work at the other end of the test link. The test will be to attempt a two-way contact on 10 GHz video. It's just a preliminary test

and I'll fill you in on the results next month.

Don't let video operation or SSB operation displace wideband FM operation. All modes have their place, and I have had lots of fun with wideband FM just experimenting and trying different modes of operation.

Well, that's it for this month. As always, I will be glad to answer questions concerning this and other related subjects. Please send an SASE for a prompt reply. Best, 73 Chuck WB6IGP.

73

COMPUTER PROGRAM IN BASIC FOR COMPUTING XG

Example of sample calculation:

Wavelength in MM = 299780 / freq. in MHz

Example: 28.9139 MM = 299780 / 10368 MHz)

Guide Wavelength Program

1 REM PROGRAM COMPUTES THE GUIDE WAVELENGTH "Xg"

2 REM OF SPECIFIED WAVEGUIDE SUCH AS WG-20 OR 16

3 REM FORMULA USE Xg=WAVELENGTH/SQR

(1- WAVELENGTH/2*a)^2

4 REM FOR WAVEGUIDE 16 OD= 1 INCH BY .5 INCHES A=.9 INCHES

5 REM FOR WAVEGUIDE 20 OD= .5 INCH BY .250 INCH A=.170

6 REM PROGRAM FORMULA COMPUTES IN MILLIMETERS

8 INPUT "DIMENSION 'A' OF YOUR WAVEGUIDE IN INCHES",A

10 INPUT "FREQUENCY IN MHZ ",F

22 X=299780/F

23 PRINT "WAVELENGTH FOR FREQ SELECTED ",X," MM"

24 B=2*(25.4*A)

65 G=X/(SQR (1-(X/B)^2))

80 PRINT "Xg GUIDE WAVELENGTH IN MM ",G," MM"

84 H=(G/4)/(25.4)

90 PRINT "1/4 guide wavelength in inches is ",H,"inches"

94 PRINT

96 GOTO 10

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The Case of the Mystery Rig

I'm going to assume that, because you read this column, you're at least somewhat technically inclined. So, I can also assume that you have been to hamfests and have occasionally picked up a "mutl" of some kind, mostly because it was cheap and it looked like a challenge. I know I've bought things I couldn't possibly use, just for the puzzle they presented, or because I rationalized I could sell them after I fixed them. (That almost always turned out to be a bad idea which resulted in my working for about \$4 an hour.) Nonetheless, I've enjoyed owning some of the "mystery rigs" that have followed me home now and then, and some of them are still in active use in my station.

What First?

OK, you bought a radio or some other electronic marvel for next to nothing. You know it doesn't work. Where to start? Well, before you plug it in or insert batteries, consider taking a look inside. You might be surprised at what isn't in there! Recently, I picked up a

Uniden 10 meter rig for a ridiculously low \$10. The seller didn't hide the fact that it didn't work, but I sure was surprised to find that the microprocessor had been removed. Ouch.

If the radio looks complete, go ahead and apply power. One exception would be in the case of antique-vintage gear whose electrolytic capacitors might not have seen voltage in many years. By simply turning such things on, you might literally blow those caps to smithereens! A Variac is very helpful with that kind of equipment. Another exception would be if you see any signs of a short: burned parts or a charred PC board. There's no sense in repeating a disaster.

With modern, solid-state gear, a Variac is a bad idea. First of all, modern electrolytics don't blow up (well, not very often, anyway), and second, many devices employ switching power supplies or regulators, and they don't like the gradual power approach one bit. Most just won't work at all below a certain voltage, but will suddenly spring into action above their thresholds, thus defeating the purpose of gradually raising the power. And some will actually malfunction on low voltage in such a way that you think something's broken when it isn't. So, go for the gusto and give it the juice. Just remember, where

there's smoke there's fire, and you sure don't want one on your workbench; if you see any smoke, turn the thing off quickly.

Zip

Most likely, though, what you'll see is nothing at all. Or, perhaps, the pilot lights or display will come on but nothing else will happen. Can you fix such a beast?

Sure, why not? Naturally, the best thing you can do is get the schematic. For a currently available or recent-vintage rig, that should be no problem. Unfortunately, many hamfest treasures are older or of oddball origin, and you may have trouble getting the data. If you have packet radio capability, I strongly suggest you put up a notice looking for help. I recently did that after I brought home a Santic HT-1200 2 meter walkie. This older radio falls into the worst of both categories: it's old and it's relatively obscure. Yet, within a week I had the diagram and owner's manual in my hand, thanks to a caring ham who also had a broken '1200.

If you've got the diagram, you should be looking at a fairly straightforward repair job. That is, if the previous owner hasn't already botched the rig's insides. Unless the price is *really* low (as it was on the '1200), I avoid any gear which has had obvious tampering. There's an old saying about driving a car: Always drive as if everyone else is crazy except you. I feel the same way about technical work: Everybody else is incompetent. Obviously, that isn't really true, but enough people are that trusting another's work is asking for big trouble.

Which Came First . . .

When exploring a broken rig with a muddy history, it can be hard to tell which problems were original and which were the result of incompetent repair attempts. Let's examine the case of that Santic walkie; it's a great example of what you can run into. When I got it, it had an obviously destroyed tantalum capacitor. The seller pointed to it and told me that "that resistor is blown." That's all that's wrong." The component misidentification and the lack of the radio's back cover told me I was in for some real detective work.

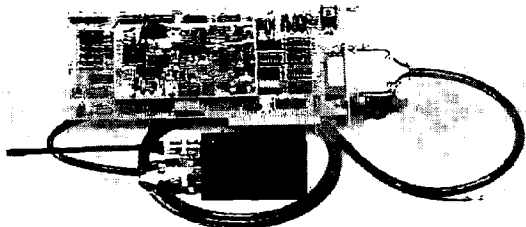
I hadn't yet gotten the schematic but, luckily, there was enough left of the capacitor that I could read its value. The part was charred and the top of it was completely missing. From experience, I knew that the most likely cause of that kind of catastrophic failure in a tantalum is reversed polarity. That's about the worst thing you can do to a radio. Uh oh, could someone really have made that mistake?

It didn't seem likely. The battery pack obviously had been replaced, because its wires had been spliced onto the old connector. But, the positive terminal was connected to the red wire, and the negative to the black, so that seemed normal. Plus, the external power jack had a series protection diode, so reversed polarity there wouldn't make it to the inside. Hmmm. I guess that cap must have blown for some other reason.

More Clues

After replacing the cap, I applied power to the rig through the external power jack. Naturally, the thing didn't

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work. Wait a minute, the display came up for a second or two and then quit. A quick check revealed that the blown cap was part of a regulator circuit consisting of a transistor and a zener diode; the zener symbol marked on the PC board was the tip-off that it was a regulator. Both components were blown. Too much voltage? I still couldn't be sure. I replaced them and tried again. This time, the display came on and stayed on, and the keypad even worked (!), but there still was no audio and no transmit. Apparently, nothing but the micro was getting power. Scoping all the pins on the audio power amp chip showed that none had any voltage. I assumed that no power was getting to most of the rig (I was wrong, as you shall see). At this point, the hunt became fruitless because, without the diagram, it just wasn't possible to follow the maze of wires to find out where the power was disappearing. I put the rig away and nearly forgot about it.

A Map

When the schematic arrived, the chase was back on. The first thing I discovered was that the seemingly impenetrable forest of wires and transistors was actually a fairly simple electronic TX/RX switching circuit. But, the Q numbers in the diagram didn't match the ones on the board! Which transistor was which? Wait a minute, there's another schematic in here, and it has the right numbers. They must have had more than one version of the board.

Now that I had the correct schematic, I quickly found that the transmit switch transistor was blown. I popped in

another one, and the TX LED now worked when I pressed the PTT. I hooked the rig to my dummy load/wattmeter and keyed up. Nothing; the transmitter wasn't working. But I figured that, if I could get the receiver to go, the rest would fall into place. So, I ignored the transmitter and focused on why I had no audio. Why wasn't that chip getting power?

It Ain't Supposed To

Following what appeared to be the DC line of the audio amp chip (the big electrolytic to ground gave it away), I came to . . . a transistor. I should have known: The amp chip wasn't getting power because the squelch circuit was keeping it turned off. Sure enough, the other side of that transistor had full voltage. And, the transistor was good. So, there was something wrong with the squelch circuit. I followed the line back through a couple of transistors to the squelch output of the detector chip and scoped it while I turned the squelch control back and forth. Sure enough, it jumped up and down just fine. That meant that the detector chip was getting power and was, in fact, working. Next, I checked each of the three transistors between it and the squelch transistor. They were good. So were the two diodes. So why the heck wasn't this thing working?

Arrggggg

I must have spent over an hour going around in circles with this thing. Then I saw it. The wire going to "point B," which was one end of a small coil connected to one of those squelch tran-

sistors, was supposed to be for an optional tone decoder, which this radio did not have. That wire shouldn't have been there, yet there it was, going to the microprocessor board. And wait a minute, there was supposed to be a wire sending an "unmute" signal from the micro connected to another point only about a quarter of an inch away. And it wasn't there! You guessed it: Somebody had broken the wire and resoldered it in the wrong place. I moved it back and, wow, the receiver came to life! Now I was getting somewhere.

Can You Hear Me?

A quick check on the wattmeter showed that the transmitter still wasn't working. The diagram showed that the unmute signal enabled the transmitter as well as the receiver, so I had hoped that everything would be fixed. Obviously, the transmitter still wasn't getting power. Or was it? I had never actually listened for it; perhaps it was worth a try.

I set the frequency to 0.52 and keyed it up into the dummy load while listening on my other rig. Son of a gun, there it was, dead on frequency and with good audio! My victory thrill turned to sudden defeat when I realized what that meant: a dead final. Yuck. Sure enough, the final was connected right across the incoming DC line, before the regulator. Nothing there to protect it, and, if the polarity had in fact been reversed, that final would have been a forward-biased diode directly to ground; pretty much a dead short. But then I noticed that there was a 1 ohm resistor

between the transistor and the DC line. An ohmmeter check showed it to be 2.6k ohms! I popped in a new resistor and, wham!, 4 watts out, just like it was supposed to be. The resistor had blown, protecting the transistor.

So, the radio was fixed. Well, almost. I was about to consider it finished when I took another look at the battery pack. Yup, the positive goes to the red wire, which goes to . . . I looked at the PC board and saw that positive was going to ground. Backward. That connector must not have been the original one, and the previous owner had just assumed the wire coding would be the same. So that was it: The radio had been connected backwards after all. Case solved.

A Thought

Many people assume that a reversed-polarity rig will be completely destroyed. Certainly, reversing the polarity is pretty destructive. Often, however, the regulators and semiconductor switches which are directly connected to the DC line will blow, protecting the rest of the circuitry. Sometimes, as in this case, most of the radio will be fine and well worth fixing.

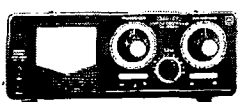
The End

I hope this little excursion has helped you see what you can be up against when you don't know who else has been inside your new find. Never assume anything, and happy hunting! Until next time, 73 de KB1UM. Hey, anybody happen to have the back for a Santec HT-1200? I have one in good working order that could use it. **E7**

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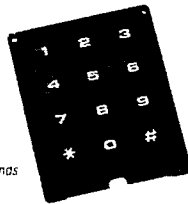
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CIRCLE 10 ON READER SERVICE CARD

Amie Johnson N1BAC
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Notes from FN42

I received a phone call from Dave Benedict W8REN of Troy, Michigan, one evening. I guess that isn't too spectacular, but he had always wanted to know what the "Notes from FN42" meant. Well, for those of you who are involved in VHF/UHF contesting it might not be too good a question, but for the rest of you it might make you wonder.

Somewhere in the "dungeon" I have a booklet from the ARRL explaining the grid system of the earth, but it seems to be hiding, so here comes my simple (hopefully) explanation.

The earth is divided up into grid squares, each measuring 10 degrees of latitude (600 nautical miles) and 20 degrees of longitude (0 nautical miles at the poles and 1,200 nautical miles at the equator). Each square is given a two-letter designation. Each of those squares is further divided into 100 squares, each one degree of latitude and two degrees of longitude with 00 in the southwest corner and 99 in the northeast corner. The coordinates of Peterborough, New Hampshire, are approximately 42° 52.5'N and 71° 57'W. Those coordinates fall into the FN primary square and 42 secondary square bounded by 42° to 43° latitude and 70° to 72° longitude, thus FN42. Hopefully this explanation has not confused anyone.

Regular readers of this column know I'm always trying to get others involved in this wonderful hobby of ours. I try to keep my eye out for examples of people getting involved and report them in this column.

One of those examples is Chris Edsorn N0CUH. Chris works at the Crocheted Mountain Rehabilitation Center in Greenfield, New Hampshire. I remember talking to him on one of the local repeaters when he moved into the area. He was looking for some hams in the local area to help him start a ham club at the center. I am happy to report that he found some help and is very busy developing a ham club and teaching those with disabilities the joy of ham radio.

I attended the open house at their new ham shack. One room in the basement of a building has been turned into operating positions and meeting space. Operating the day of my visit were a 2 meter FM transceiver, a 2 meter packet station, an HF station, and a computer used to learn Morse code. There are approximately six operating positions with coax hookups and both AC and DC power available.

The room was very busy that day

and very crowded with young people in wheelchairs and on crutches, some helping with the operation of the equipment and others providing information to new young people who came to find out what was happening. Several of the older ham volunteers were there. They had traveled over two hours to get there, and they had done it many times before to help install the antennas and ready the shack. That's dedication, folks, and getting involved!

I was very heartened to see one young lady in a wheelchair spell her name in Morse code on a practice oscillator and to observe the joy in her eyes when she realized what she had done. WOW! What an experience!

Do you want that same kind of joy? It doesn't have to come from working with disabled young people like Chris does. It can come from helping with classes or testing sessions, or helping with public service during emergencies or worthwhile public events. Foster the use of ham radio on the air. Be positive in your attitude toward amateur radio. Don't be part of a problem, be part of the solution.

Finally, December is a holy month for many of our world's religions. I wish all of you the joy, peace, and prosperity that you deserve. May our world's troubles be solved and peace to all mankind endure.

Happy Holidays! 73, Amie N1BAC.

Roundup

Mellish Reef Letter from Murray D. Adams, WA4DAN: Mellish Reef is located at coordinates 17° 24' S, 155° 51' E. Herald's Beacon Inlet is the only part of the reef that remains above sea level at high tide—it is not much more than a sandbar. It's been over 4-1/2 years since the last Mellish DXpedition, but in January 1989 a group reported that the islet was approximately 150' wide by 800' long.

Since the last operation, a couple of major storms have passed through that area; hopefully things have not changed drastically during this interval. The islet is basically pear-shaped. The intent of our operation is to set up two separate, completely self-contained sites as far apart physically as possible to try to reduce adjacent station intermod. One site will be at the north end and the other site will be at the south end.

One site will contain three HF stations while the other site will have two HF plus one 6 meter station. They will strive to listen as much as possible in the U.S. General class bands.

All DXpeditions have certain logistical difficulties to overcome. Mellish Reef is no exception. Heat (there's absolutely no shade) is a concern, along with the effects of salt spray on the equipment and antennas. Fitful rest on

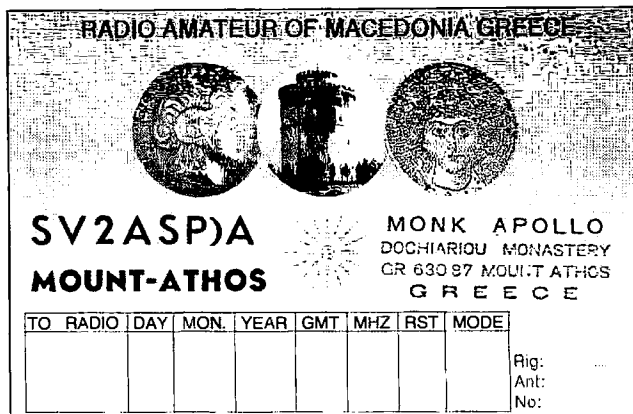


Photo A. The beautiful QSL of Monk Apollo SV2ASP.

this type of DXpedition is a rarity. For some insight on this, read the fascinating account of the AHIA/Howland Island DXpedition earlier this year.

The Mellish Reef team has spent the last six months planning and working on the logistics for this DXpedition. We all look forward to contacting you from the reef.

The callsign for the operation is VK9MM. The operators are: VK4CCR, VK2BEX, V73C, K5VT, VK2BJL, P29DX, WA4DAN, and G3WGV.

We plan to operate CW, SSB, and RTTY.

Power will be supplied by one 4 KVA and two 3.5 KVA generators. 850 liters of fuel will be transported, and in addition, 80 liters of oil.

Equipment has been donated by Dick Smith Electronics, Coman Antenna Co. Australia, Emtronics Australia, GAP Antenna Products, Cushcraft Corp., Heil Sound, Dunestar Systems, and Oklahoma Communication Center.

On arrival, the team hopes to quickly get a couple of the stations operational using one yagi and one vertical while the rest of the team is ferrying gear to the two sites and assembling antennas, tents, etc.

The QSL manager will be Bill Horner VK4CRR, 26 Iron Street, Gympie QLD 4570, Australia. Please include SASE/SAE + \$1/IRCs. Any donations will be gratefully received and used to offset the high cost of the DXpedition. QSLing will commence by December 1, 1993.

Many thanks to all of the major DX foundations, many national regional and local DX clubs, and literally hundreds of individual DXers whose support has made this DXpedition possible. Our primary objective is to work as many stations as possible and to give as many who need it a new country.

[As most of you DXers realize, the Mellish Reef DXpedition completed its operation several months ago. This report did not arrive at 73 in time for advance notice. I hope to receive an update from WA4DAN in the future.—Amie]

USA/Mt. Athos Letter from Walery Sawka KB2FIV: I was more than hap-

py to see Father Apollo's SV2ASP statement printed in 73 magazine. Let me explain.

About eight years ago, I visited Mt. Athos for the first time. I fell in love with the beauty, people, and spiritual values of the place. It is still a very unique place on our planet. I have been traveling there every year since, not as a tourist, but as someone who shares. I work with them, pray with them, and share their humble life.

I am also a ham and faithful reader of 73 magazine. Through a short note, I learned about the existence of Father Apollo. After a strenuous walk through rough mountains, we met in the magnificent Byzantine Monastery of Dochiariou. He proudly displayed his 2 meter rig. It was an old Kenwood and some wire dipoles. He loved them and was talking about it with gleaming eyes. He had problems, not only with the Administration of Mount Athos to get an operating permit, but with the power supply as well. The monastery operates the electric generator only during the day for using power tools. The rigid monastery schedule doesn't leave much time for hamming. The donated old Japanese generator is not only noisy but produces 117 volts instead of the European 220 volts.

Father Apollo is working hard, long days and prays long nights. He is friendly, gentle, and always smiling. Two years ago disaster struck—a canister of cooking gas exploded! Father Apollo survived with bad burns of the face and was almost blinded! His being able to see is one of the miracles of the Holy Mountain. And then, last year, there was the unpleasant experience with unauthorized transmission of DJ6SI. With my knowledge of Mt. Athos and all the documentation given to me, I don't have even the slightest doubt that it was illegal. How can the ARRL pass such easy judgment?

Father Apollo's problem might happen to us, too—we can become the victims of unauthorized transmissions, tampering with packets, etc. In my opinion, Father Apollo has become the victim, and I hope his faith in decency and people won't be disturbed again. I am including his famous QSL card so

that others can see what they are missing.

If anyone has any questions, please contact me: Walery Sawka KB2FIV, Box 290, New York City NY 10028.

OKINAWA JAPAN

David Cowhig J76CBQ/WA1LBP
AmCon Naha
FBU PSC 556, Box 840
FPO AP 96372-0840

June brought Telecom Week and a demonstration of satellite communications, packet radio, ham TV, ham facsimile using the old NEC mini-fax machines available cheaply here, and eyeball rag-chews in Urasoe City. The packet radio stations used the DX-TERM Japanese language packet radio software which automatically switches into the display mode when it hits a NAPLPS videotext message on packet radio. It was very startling to be watching the kana and kanji of a Japanese packet message moving up the screen when suddenly the computer started to draw a full-color cartoon or map. You have probably seen videotext pictures on the news or weather bulletin channel of your local cable TV system. At the Telecom Week hamfest aspiring YL ham 10-year-old Toshitaka Ayaka, daughter of Toshitaka-san JS6KVP, told me she will take the August JARL ham class in Naha. A video-equipped Apple computer generated this picture of Ayaka, her 6-year-old brother Tsutomu, Toshitaka-san JS6KVP and myself.

NAPLPS attracted many followers in Japan, where drawing cartoons is a very popular hobby. *CQ Ham Radio*, Japan's biggest ham magazine, runs works of art by ham cartoonists every month. Some of these images make it onto the Japanese packet radio and

landline computer networks as NAPLPS images. NAPLPS image files are a series of graphics commands which the receiving computer executes to draw a picture. A nice drawing can be sent in a file of 1 or 2 kilobytes which would require 50 kilobytes or more if sent as a bit-mapped image. You can find NAPLPS software such as NALVIEW.ZIP and other series of NAPLPS programs in ZIP files beginning with NALP written by enthusiastic Japanese hams such as Roy JM1VSP Kurashima Akihisa on the AMRAD BBS (703) 734-1387, or the Virginia Connection BBS (703) 648-1841 with its super-fast modem. Looking at this collection of pictures and playing with the software will give you an idea of what NAPLPS is like. I translated the documentation from Japanese several years ago. Creating a good NAPLPS file is hard. I would like to blame NAPLPS but the real problem is that I am not an artist.

I hope that all hams throughout the world are enjoying learning about the Okinawan culture and life. My fellow hams on the island are certainly enjoying seeing their news in 73.

PHILIPPINES

Lorenzo D. Gaston DU1CHD/6
PO Box 27
6116 Silay City, Neg. Occ.
Philippines

DX stations who wish to operate temporarily during their stay in the Philippines must apply for a reciprocal license before bringing their transceiver(s) into the Philippines. Section IX of the Philippine Amateur Radio Regulations states that "The NTC may authorize a person who is a resident and citizen of a foreign country to operate his or her amateur station while temporarily in the Philippines provided he or she is a holder of an appropriate ama-



Photo B. Computer-generated picture from Okinawa.

teur station license and an operator's license or certificate issued by the government of the country of which he or she is a citizen and provided that the same country has a formal or an informal reciprocal agreement with the Philippines. He or she should be encouraged to affiliate with a local amateur club for better camaraderie and fellowship." All reciprocal license call signs have their original call suffixed by the word "portable" or "mobile," followed by the appropriate DU district number (from /DU1 to /DU9 only, no /DU0). For example, N1BAC will sign N1BAC/DU6 or DU6/N1BAC in Negros Island (IOTA OC-129) when he goes on a DXpedition here. [I'm ready, Wayne! When do we leave?—Arnie] NTC Reciprocal Licenses are usually issued with a maximum effectivity period of one year and can be renewed 30 days before the date of the expiration of the license.

The following documents are required when applying for an NTC reciprocal license: (1) Application letter stating your request to apply for a reciprocal; (2) Reciprocity agreement or Informal agreement with the Philippines. Either document should come from your country's amateur licensing authority, certifying that it has issued or will issue an amateur radio reciprocal license to citizens of the Philippines who are holders of Philippine Amateur Radio licenses and/or certificates to be able to operate his or her amateur radio station with appropriate privileges while in your country; (3) A certified copy of your license; (4) A list of the transceiver(s) (brand, model, and serial number) you plan to bring to the Philippines; and (5) Certification from your country's amateur radio licensing authority stating it has no objection to your operating your amateur radio station in the Philippines.

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The NTC, in the future, may also require other documents or may not require all of the documents listed above, so please write to the Philippine Amateur Radio Association for the latest requirements months before visiting the Philippines. The address is: PARA Secretariate, G/F Remedios Bldg., 55 A. Rocas Ave., 1100 Quezon City, Philippines. The phone numbers are 96-40-69 and 98-47-05.

73. DU1CHD/6.

TAIWAN

Tim Chen BV2A
PO Box 30-547
Taipei, Taiwan
China

Hello, everybody! I would like to submit this statement about our activities and the progress of ham radio on this island to the readers of 73 magazine.

All hams are delighted to hear the long-awaited announcement that the Chinese Taipei Amateur Radio League (CTARL) has become the 126th member society in the International Amateur Radio Union (IARU) and its Region III since October 30 and November 7, 1992, respectively. We tried hard over the past years to obtain those very memberships. We are grateful to all those societies over the world for favoring us the votes (71 votes without a nay, unanimous!). We are encouraged and believe that we will have more and

closer relationships and cooperation with all concerned in the future.

There was a celebration party held in the Mandarin Hotel, Taipei, on December 12, 1992. Not less than 400 hams and guests were present, and the buffet dinner was served from the evening until midnight. Special guests attending were Legislator Y. S. Lin; Mr. C. Y. Chen, Director of Post and Telecommunications Department, M.O.C.; Mr. Chen Yen, Division Chief of International Department, M.O.F.A.; and many other VIPs.

In April, the government's examination for ham operators will take place in central Taiwan—Taichung City. We are expecting 2,000 or more candidates and those passing will turn out 700 more new stations at the end of the year. The continuing growth of hams will make it possible to hold two examinations every year, beginning in 1993.

CTARL members in Taipei, Taichung, and Kaohsiung cities are in full swing, organized to serve the newcomers. Usually they supply cold drinks, stationery, and code practice for the last dash at the venue at no charge.

The CTARL is going to re-elect the second-term directors and president. I will be retired from CTARL service, but will never cease to be a ham. All visitors from abroad should call as usual if they happen to be in Taipei.

Next month I will report on the expedition to initiate the first BV9 on Quemoy Island.



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NEVER SAY DIE

Continued from page 4

my own enthusiasm, and you probably could care less about music. Well, that's a shame to miss seeing or hearing beauty. It's probably too late now. Your parents should have opened the worlds of music, art, and books to you. Yeah, art. I've been in every major art museum in the world and have just about every book on Hopper's paintings ever published. Did I tell you about the time I was working on a Guggenheim grant at the Guggenheim Museum on Fifth Avenue? Probably did.

Say, I'm beginning to ramble like Old Indiana Jones. Have you been enjoying the summer Indiana Jones series? I particularly enjoyed the one where he met Sri Krishnamurti. I've always enjoyed K's books and used to go to his lectures in New York. I liked his philosophy, which they got across nicely in the Young Indiana Jones program. I suppose religious fanatics might be upset by his ideas.

Speaking of religion (a no-no), a recent *Newsweek* had an interesting article about the latest scientific ideas on how life got started. I was pleased to see that there are more and more scientists leaning toward the Hoyle theory. I think I mentioned Hoyle's book, *Evolution From Space*, sometime back. I like things to make sense, and this does.

If I can make some time I'd like to start doing a series of audio tapes which would discuss the music, books, amateur radio, and other things I'd like to share with others. A few die-hards got irritated with me at Dayton because I didn't talk about amateur radio the whole time. Heck, I talked for two hours and was only barely started. I did talk about my concerns about the ability of us continuing to keep our priceless frequencies without giving anything much in return as a quid pro quo. But then I've been writing about that theme for years. I'd like to get around to more hamfests to talk, but between music and computer shows, plus a little work to do around here, I've boxed myself in. If I get some spare time I'd like to organize my library and get the bam in better shape. And maybe chase a little DX. I was having fun on 10m until the sunspots killed it.

As soon as I can get set up with a remote transmitter system I'll be looking for duplex contacts . . . mostly on 20m. Oh yes, don't forget, if you talk to JY1, pass along my regards, and tell him I'd like to help him get his educational system out of the basement. Jordan has the only school system they've measured that's worse than ours. We're talking world-class bad, which is a real shame. That's a terrible legacy for his people. The bright side is that their kids are only just a little dumber than ours. But we're working

diligently on dumbing our kids down even more, so who knows.

Now, please don't forget to write. Let's at least see a QSL with a rating for a book, gadget, or kit.

Ham Club Responsibilities. How Does Your Club Shape Up?

In my reports to the New Hampshire Economic Development Commission and our humongous citizen's legislature, I was expressing my frustration at their allowing excessively lousy overpriced schools, ridiculously expensive health care, poverty, rampant crime, drugs, and so on to continue . . . while there are some practical, inexpensive solutions to all these problems. I happened to look up the word "civics" in my dictionary. Check it out, since it applies to our beloved hobby, too. "The division of political science dealing with the privileges and obligations of citizenship."

It's the quid pro quo bit again. If you want to enjoy the privileges of citizenship, then you must fulfill your obligations. You can mull over the many privileges you enjoy as an American citizen, then start considering how well you're handling your attendant obligations. Like being an informed voter, for instance. If you were informed, you wouldn't keep sending the same old crooks to Congress, term after term . . . and then ask for term limits to stop you from doing this.

So, what has this to do with ama-

teur radio? The quid is our privilege of using billions of dollars worth of frequencies as our playthings. The quo is our obligation to provide something in return, other than abuse.

What should we be doing? Well, we're supposed to be a technical hobby . . . a training ground for youngsters . . . and for each other. Considering the complications of technology today, it's difficult for us to become experts on everything. This is where our clubs can help. Suppose every club meeting started off with a technical talk by one of the members. One might explain how RTTY works. Another about SSTV. Others could explain about packet, satellite communications, aurora, moonbounce, fox hunting, and so on. You might assign club members the responsibility to learn about spread spectrum, digital radio, digital video, compression algorithms, fractal compression, orthogonal frequency division multiplex, and so on . . . and then have them explain these concepts to the club. Many hands make light work and it's exciting to learn new things. You might even find more hams coming to club meetings, and more getting interested in trying new modes and bands.

I keep reading all of the ham club newsletters I get, hoping to see signs that some of our clubs are taking our obligations as hams seriously. I'm not encouraged. How about your club? Let

Continued on page 82

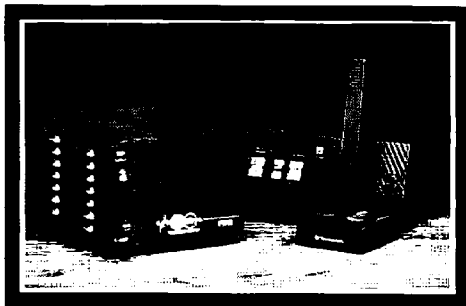
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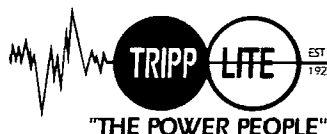
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NEVER SAY DIE

Continued from page 80

me know if you run across any signs of life.

Psyne

What's been your contribution to the world . . . so far? It's probably just the result of another bit of deformed DNA, no doubt resulting from my father smoking before I was conceived (it was Fatimas then, but it was Camels that eventually killed him), but I've always had this weird urge to somehow contribute something to the world during my short visit. It has to be a genetic problem because I don't ever recall any philosophical discussions along this line with anyone in my family. Or theological either.

Progress seems accepted as being beneficial, so I've always been inclined to do what I could within my limitations to help the world progress. My contributions have admittedly been minuscule, but satisfying to me.

How about you? Have you a feeling on some level that you owe the world a little positive push, or are you satisfied to be just a taker?

There are plenty of things you could do which would put a little more positive spin on our world. It's probably too late to get you to learn to write so you can help others to find out about interesting things, or even just enjoy what your mind provides for them. But, be-

ing a ham, there are a ton of scientific areas you could research and help pioneer. You've got a basic understanding of technology which could be put to excellent use. If you don't, you should have. That's part of your ham responsibility. I hope you haven't been cheating on this.

One area wide open for scientific investigation, one which doesn't even have to be expensive to pioneer, is the field of subtle energies. I like the term. I recently attended a conference in Monterey on the subject and was impressed with the progress that's being made. But even more, I was excited to find that this is such a new scientific field that almost anyone can get into it and produce worthwhile data. Yet I only ran into one ham at the conference. Tsk.

Subtle energies? What'n hell are they? That's the great part . . . no one really knows much yet.

Scientists have always been uncomfortable with anomalies. They really hate extra sensory perception and psychokinesis. They hate 'em so much that most scientists refuse to acknowledge that anything of the kind exists. Pathological skeptics. Having had enough proof in my own life that some sort of instant communications is possible over large distances; having had enough fortune-tellers read my tea leaves with incredible accuracy; and having read a hundred or so books about other carefully researched cas-

es, I've been impatient with scientists for so blindly ignoring all this data.

Reincarnation, the soul, past lives, out-of-body and near death experiences, UFOs, and so on are all scientifically unexplainable, despite endless detailed reports substantiating their existence. Of course one problem is the profusion of charlatans, both intentional and unintentional, taking advantage of the situation. Another is that even some of the better mediums fudge at times, trying to make up for the unpredictability of their gifts.

Despite the seemingly endless number of scams, many centered in La-La Land (aka Southern California), often dressed up in scientific-sounding baloney, down there somewhere there may be some important breakthroughs waiting for you to lift the right rock. As a registered skeptic I enjoy the hokum about scalar physics, subliminal tapes, hemisync tones, and so on. If you do get involved with this high weirdo stuff, try not to get swept up as a believer.

So I've put psy and science together to describe a still almost virgin field which is out there ready to be explored. Psyne. I like that better than psience. If you can harness psy, you'll have it made. ESP, clairvoyance, psychokinesis. Wow! It'll be a lot easier finding out how this stuff works than trying to disprove it, where you have millions of people who've had psychic experiences to face. The last statistics

I saw claimed that over 67% of Americans have had a psychic experience. So let's kick some sand in the face of the scientists who won't even try to explore psi and the other anomalies they're ignoring. My experience in Monterey is that you are not going to be alone.

Yes, there's a need for an honest communications medium . . . a publication . . . to help this new field develop. But with many of the potential ads being for unproved products and services . . . and I'm being very kind with that description . . . it's probably still a little early for a magazine. And where would I ever find people to honestly evaluate the products so we'd know what really works and what's baloney? Heck, science doesn't even have a clue as to how the placebo effect works.

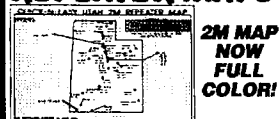
So here's a field where the frontiers are still accessible. How does acupuncture work? How does ESP work? Where does herbal medicine fit in? Can rainmakers make rain? What about dowsing? There's a whole world of weirdness out there which needs honest investigation. So, if you have any pioneer spirit, and would like to contribute to the world, there's plenty to do.

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number of papers published. Being published results in grants, prestige, larger laboratories, and positions on decision-making committees.

One thing scientists know is that it is much easier to publish papers that don't challenge the present orthodoxy. As a result, few career scientists are interested in investigating anything which might cast a doubt on established beliefs. So they work over and over on smaller and smaller areas, and those generous grants keep coming. The end result is that science today has lost its spirit of adventure . . . and that leaves a wide-open opportunity for the amateur.

If you look back on history, almost all of the major breakthroughs in science were made by amateurs. And most of them had to fight the entrenched scientific community of the day. It took years before scientists recognized the work of Max Planck and quantum mechanics. As Planck pointed out, his new theories were not accepted by the scientists of his day, it's just that eventually the old scientists died.

There are whole worlds of science (and psynce) that are wide open for anyone with the guts and a never-say-die attitude.

Saving Amateur Radio

In line with my normal gloom and doom approaches to our hobby, I fear that, perhaps by accident, someone

will be appointed as an FCC Commissioner who has at least a slight grasp of communications and is not just reaping a political reward. As a result, the legitimacy of our exclusive rights to several billion dollars worth of public radio frequencies might be challenged. My proposition is simple: I suggest we spend a little time building at least a feeble leg to stand on should such a day of reckoning surprise us.

You might want to suggest this to your ARRL directors and see how far you get with them. Something like this might give you a hint as to how much of a voice you really have with the League.

Fortunately, past Commissioners in recent years have been too wrapped up with avoiding more mighty matters to notice us, so we've been sailing along in the foolish belief that it is our good works that have preserved our hobby. My thesis is that we'd better damned well re-invent our hobby before the Commissioners notice that we're no longer paying our dues.

I've been enjoying what is essentially another generous government hand-out . . . the use of our bands . . . but I keep wondering how long it's going to be before the piper comes around, wanting to be paid. One of these days some Japanese firm pushing a new satellite communications system is going to need some channels for the service and is going to start looking closely at all those lovely megahertz we're

not using and figure which senators and congressmen will have to be bribed to get those frequencies more productively allocated. Less than one million dollars invested in the right congressional re-election campaigns could free up several billion dollars worth of channels. Our government is famous for outstanding bargains when it comes to congressional bribery. And who were some of the biggest collectors of these bribes in the recent past? Secretary Bentsen and VP Gore!

Hmm, come to think of it, I've been a registered lobbyist for around 20 years or so. Maybe there are some companies who'd like to have some help in getting tons of radio channels so they can sell the equipment to use them? No problem, I know exactly how to go about it.

In my past gloom and doom editorials I've suggested a new reason for our existence, other than the dubious proposition that well, we were a help many years ago. We have to remember that gratitude is one of the least felt of all human emotions and stop betting our whole hobby on it. I've recommended that we establish ourselves in the role which was so successful for us in the 1950s, as the major supplier to our country of high-tech career-oriented youngsters.

In line with this I've been encouraging ham clubs to not just accept youngsters, but to go out and get them. I've some further ideas along

this line. I'd like to see the main club activity be the promotion of the hobby instead of just a meeting place for old-timers to kvetch about how bad the bands have gotten lately, what with all those lousy no-coders and everything, and how we need to raise the entry license to 50 wpm, not get rid of the code, and keep out the damned riff-raff.

In the days before the ARRL's Incentive Licensing proposal to the FCC, we had over 5,000 school radio clubs. Now we have only a few hundred left. So what I'm proposing as a major ham club activity is the re-establishment of school radio clubs, under the guidance of local ham clubs.

The school clubs should meet at least once a week. The youngsters would be invited to attend the local ham club monthly meeting where there would be show-and-tells on all of our main ham activities, such as DXing, CW, packet, RTTY, SSTV, repeaters, QRP, satellite communications, moonbounce, ATV, foxhunting, and so on. Then how about a short technical talk on AC, DC, tuned circuits, antennas, feedlines, and so on?

If there a half dozen schools in your area, each might have 20-30 members, and you might be able to get maybe 10 from each school club to come to your club meetings, if you keep 'em interesting. If we only got five new hams each per year out of 50,000 school radio clubs, we'd be adding

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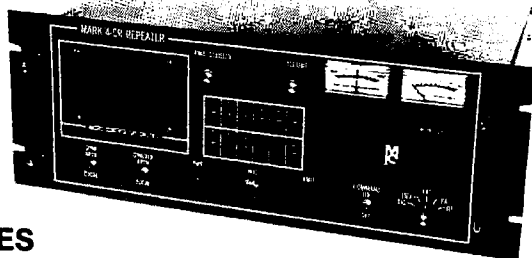


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250,000 new hams a year to our hobby, and you'd make it much more difficult for me to zip down to Washington and sell out our bands to the highest bidder.

I wish I were exaggerating about how easy it would be to take hundreds of megahertz away from us. And just one attack like that could get the FCC to thinking about how much trouble we are and how little we offer. In return for all that aggravation. The next thing you know, pffft. Say, who could we sell our old ham rigs to? I suppose we could put 'em up on 11 meters and join the happy HFers. Yet, considering the sophistication of today's direction finding technology, I dunno.

How much is your ham ticket worth to you? Would you sell it for \$100, with the understanding that you'd never operate again? How about a \$1,000? What's your price? Okay, I know you've got a price, so we're just haggling. Let's say that the average ham will sell out for \$10,000. Then, how much would you be willing to pay to get a license? How much are your ham privileges worth to you?

Some DXers think nothing of spending \$100 just to get a new country. We've had hams travel around the world making a business of this. No "donation," no QSL. I've been hamming for so many years I can remember when a "Green Stamp" was a dollar bill. Now, if you want that rare DX QSL you'd better enclose a \$20 bill.

If your amateur radio license has a value for you, how much would you pay right now to preserve your privileges? Would you spend \$10 a year? \$50? \$100? Yes, I know, you're a member of the League and they're supposed to be preserving the hobby. Other than threatening to sue the FCC every now and then, in what way are they doing this preserving? I haven't seen them doing diddly to get our crummy bands cleaned up. And that despite the creative ideas I've proposed to help them. Too much trouble, I guess. Let's wait until the FCC really gets fed up with the mess we're making and then sue them if they try to give our frequencies to some outfit willing to buy them via generous gifts to Congress.

No, I don't know of any other outfit doing what needs to be done either, despite there being several almost invisible "national" ham groups. And no, I'm not asking for donations. If I get a big need for money I can go to Sony and explain how for maybe as little as \$20 million I can get them 20 MHz of choice microwave channels. Oh, make that \$50m, they've got the bucks and I'll need a little extra to do the usual hidden video of my talks with Congress' best. That'll give me something to show at hamfests.

I suppose I'd better put a little disclaimer in here, just in case someone is dumb enough to think I'm serious. We don't give IQ tests as part of the li-

cense exam, so now and then I get some really weird letters. I'm often tempted to try and explain that at times I use irony, sarcasm, and even whimsy, to get across a point.

So no, I'm not here with my begging bowl in hand. But instead of asking you for money, I am asking you to cough up some time. Time to either get your local ham club to get into action or to put together a putsch and take the club over so you can get something done. Sure, I wish you'd con a few of your friends into getting 73. If every reader recruited one more reader, we'd knock the socks off QST.

But I know what's going to happen. You're going to tell me you don't agree with everything I write and not chance any put-downs from friends who hate Wayne Green. Hate lovable old me? Lovable old "a spade is a spade" me? I suppose they're still mad at me for trying to get them to stop feeding that lard pile hanging over their belts, and trying to embarrass them into saying something of interest during QSOs.

Please let me know how you're doing on getting school radio clubs going, and send some pictures of the kids you con into trying our hobby. If I don't see pictures I'm not going to believe you're doing anything.

Extraordinary Science Conference

While I was attending a Subtle Energies Conference in Monterey (CA), I came across a promotion piece for a

science conference in Colorado Springs. So naturally I zipped out to see what this was all about. The promotion promised all kinds of dumb science scams, but hey, if even one turned out to be worthy of investigation, it would be worth the trip.

The conference surprised me. First, the place was packed with hams. Wall to wall. They even had a ham rig set up and running, generating a comforting sideband garble in the background of their amplifier system for the speakers. Secondly, the hams weren't kooks. Third, some of the conference sessions were very interesting and well done. A couple of them almost got me excited. Alas, most of the rest were crackpots. I get annoyed when someone has this great invention . . . but darn, the prototype got busted on the way to the show . . . It was working just a few days ago. The chap then explains that he doesn't have any of those old letters after his name. After about one minute of talk I knew that anyway. Further, I knew right away that he'd never even bothered to learn the fundamentals of electricity.

So I sat through three days of poorly done videos and non-working demonstrations of preposterous machines. You start it with a battery and it'll generate a zillion watts of power. Sigh.

One of the bright spots was the opening speaker who talked about the experiences he'd had as a dentist with



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amalgam fillings and nickel crowns. I'll try to get his book for you and make it available through Uncle Wayne's Bookshelf. If you, or anyone you know, has any fillings or crowns, you've better read this book ASAP: *It's All In Your Head* by Hal Huggins DDS. These could well be causing you all kinds of miseries. The 50% mercury in those fillings leaches out into your system. It's enormously poisonous and can cause Parkinson's, leukemia, multiple sclerosis, diabetes, and so on. Life is tough enough without your having a mouth full of poison feeding into your system. Touch a sensitive milliammeter to your tooth filling and your tongue and see how much current your tooth batteries are generating. And when a battery generates voltage, some of the metal in the battery goes where? Into you, that's where. So why doesn't the ADA stop dentists from putting in amalgam fillings? If they ever admit the liability it could cost dentists billions. So dentists are continuing to poison us.

One of the most interesting and visual of the talks was by Bill Wysock N6UXW, who showed off a Tesla generator which flashed sparks for about 10 feet. If you've got a few bucks and would like to experiment with ultra-high voltages, you might want to look up Bill.

I was disappointed that so few in the audience spoke up to point out that the speakers were ignorant about their subjects. But then, I didn't either. I didn't know how to ask questions of someone with a power generating device who wasn't really clear about the difference between a volt and a watt. Most of these characters were looking for money to finance their work.

But there were enough interesting ideas there to keep an inquisitive ham busy for months. And some ideas could be developed into practical devices. As I pointed out to some young hams who were watching all this with eyes bugging, all you have to do is spend a few weeks learning the basics of electricity and you'll be ready to tackle some of these projects. AC and DC theory isn't difficult. Nor are motors and generators. And learning is exciting.

I might not have zipped out to Colorado Springs for the conference if the Second Annual Boulder Ragtime Festival hadn't been on the same weekend. The two cities are only about an hour and a half drive apart, so I did the conference all day and then drove to Boulder for ragtime concerts at night.

Scott Kirby had driven up there from New Orleans, where he plays on the street. Scott's now being introduced as the foremost interpreter of Scott Joplin in the world. He draws standing ovations. He'll be giving some concerts in San José in November, and later at the Fresno Ragtime Festival.

The disappointing thing for me about many of the ragtime festivals is that most of the performers seem to pride themselves on discovering long-lost rags to play. The reason they were lost is that they never were any good. Like all popular music, only about 1% is worth hearing twice. But oh, that 1%! The good rags are fantastic and addi-



At the Colorado Springs Extraordinary Science Conference. Standing (left to right): Tony Chellemi KD6IFC, Covina CA; Bill Wysock N6UXW, Monrovia, CA; Rosalie Sorrell KD6KSG, Covina, CA; Skip Juhasz WB2UFV, Colorado Springs, CO; and Jim Hardesty N2DRT, Ithaca, NY. Seated (left to right): W2NSD; Mike Dpersio KC2Q, Bradley Beach, NJ.

tive, but I doubt there are much more than a hundred of them that are winners.

So these performers exhume the dead and foul up the festivals. They're tired of playing Joplin's "The Entertainer" and "Maple Leaf Rag," but guess what the audience wants to hear? They want to hear the good stuff over and over. There are about 20 of Joplin's pieces that bring tears to my eyes. They're what I want to hear.

The other superb performer at Boulder was Frank French. I've got to get him up to my studio and do a few CDs for you of him playing Gottschalk and Nazareth, and doing some of his monologues. If I can get you to try my Kirby CDs and a couple of French, you'll see why I'll fly to San José and then drive to Fresno to hear them perform. Or to Boulder.

Kirby recorded "More Damned Good Rags" in my studio this summer, plus some of his own rags. And he's got some corks.

Well, I had a great time at Colorado Springs at the conference and meeting the hams there, plus the concerts in Boulder. It was a great weekend. And if you old-timers would pay attention, you could meet me at things like this. You can buy a year's pass on Continental

Airlines if you're over 62... which most of you are by now. The pass costs about \$2,000 and lets you fly once a week for a year. For \$2,000 you can fly first-class all year. Yes, Continental flies to Dayton. So Sherry and I zip out to Las Vegas for the CES show, then Aspen for some skiing, and to various hamfests, electronic, computer and music shows. I have my Macintosh PowerBook with me, so I'm able to work wherever I am.

I've been under some pressure from friends to check into some networks, but I've avoided 'em so far. They can be time-consuming. Sherry checks into Prodigy, if you have any traffic for me. The new Prodigy rates seem to have their customers dropping out by the thousands.

Learn To Write

It's unfortunate that our schools don't teach kids to write. Oh, they can put a few words on paper, but that's not really writing. Writing takes some skill, and that means you need to learn how to do it. I don't recall ever being taught how to write, and I notice that the recent books about our school system have the same complaint. If you could see the mail I get you'd get a better

idea of how poor American writing skills are.

Yes, it takes some practice and some education, but once you learn it is fun to write. I'll bet you have a book in you, if you'd just let it come out. So get a laptop computer and one of the cheaper laser printers and make it easy. I've tried a bunch of laptops and like the Mac PowerBook best. And they're available used for peanuts these days. I bought a 4/40 Model 140 for under a kilobuck. That's with 4 megs of RAM and a 40 Mb hard drive. That should handle anything you'll need. With it you can answer mail in a couple minutes. You can write spec sheets, ads, manuals, newsletters, and even that book. Maybe some articles for 73? Once you try a laptop you'll never go back to a typewriter again. Or a pen.

An apology.

Apparently I have innocently offended one of the more militant homo-hams by my comments about homosexuality in my October editorial, in which I mentioned that I don't condone pedophilia... they're messing with children. The WSYI Report gaily leaped to defend homosexuality, writing: "Clearly, his behavior is abnormal... Green is to be pitied."

I'm not sure I've ever made any claims of being normal. I'm just not that deceptive. But no, I'm not normal. I don't sit home like most normal people, with a six-pack watching ball games on TV and eating pretzels. I don't even like beer, pretzels, or ball games. No one is going to call that normal, I hope. I apologize if I offended any child molesters with my editorial.

On the other hand, I sit on the bed and put my pants on both legs at the same time, just like everyone else, so there are many normal things about my life. And, like any true-blue ham, I've been active on OSCAR, have worked over 300 countries, helped pioneer NBFM, was an early user of SSB, RTTY, SSTV, and 6m, have made some unbeaten microwave records, have won all the bigger ham contests for my section, have DXpeditioned from dozens of rare countries, have done moonbounce work, have sat patiently through endless roundtables, have kerkchanked thousands of repeaters, and have helped tens of thousands of hams pass the stupid code test with my superb code tapes, which I just happen to think are better than any others anywhere. Only my overweening modesty prevents me from telling you how great I think they really are.

Well, as they say, any publicity is good publicity, so I appreciate what at first glance seems like just one more wearisome Green-bashing attack by WSYI. I also appreciate the letters from other homosexual hams apologizing for the hysterical and unwarranted attack on me by a lone over-motivated gay activist.

One more thing... I do wish that WSYI would not encourage hams to sue hams, even though it makes wonderful grist for his pinko paper and no doubt sells subscriptions.



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DEC 4

FARIBAULT, MN The annual Courage Center Handi-Ham Winter Hamfest will be held at the Eagles Club, starting with registration at 8:30 AM. Flea Market. Handi-Ham Equipment Auction. Talk-in on 19/79. Contact *Don Franz W0FIT*, 1114 Frank Ave., Albert Lea MN 56007.

DEC 5

HAZEL PARK, MI The Hazel Park ARC will hold its 28th annual Swap and Shop, from 8 AM-2 PM, at Hazel Park High School, 23400 Hughes St. Talk-in on 146.64- (DART). Contact *HPARC, Box 368, Hazel Park MI 48030*.

SPECIAL EVENT STATIONS

DEC 3-5

SAN ANGELO, TX The San Angelo ARC will operate Station W5QX to celebrate Christmas at Old Fort Concho, from 0001Z Dec.3rd-2000Z Dec. 5th. Frequencies: Lower General portions of 40, 20 and 10 meters. For a certificate, send QSL with contact number and a 9 x 12 SASE to:

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FLINT, MI The Genesee County RC will operate W8ACW 1200Z-2400Z, to celebrate their 60th Anniversary. Operation will be in the General 80-15 meter phone subbands, the Novice 10 meter phone subband, and 2 meters. For QSL, send QSL and SASE to *GCRC, P.O. Box 485, Flint MI 48501*.

KALAUPAPA, HI Kalawao County will be on the air, with several SE Stations operating from the site of the Hansen's Disease Hospital, and the historic lighthouse. Phone, CW, and digital activities are planned for all bands, including the Novice subbands. Look for us at the lower portion of each subband. Listen for AH6IO, AH6IN, AH6KY, AH6KX, and others. For a commemorative QSL card, please send your card and an SASE to the home address of the operator contacted.

DEC 11

HOLLY, MI The Fenton Area ARA will operate KB8MBJ 1400Z-2400Z, during

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the annual Charles Dickens Festival. Operations will take place between 28.300/500 MHz and in the General portions of the 20 and 40 meter phone subbands. For a special card, send your QSL and #10 SASE to *Bill Coale KB8MBJ, 605 S. Broad St., Holly MI 48442*.

DEC 11-12

TROY, NY The Troy ARA announces its 2nd annual RTTY Sprint. The contest period this year will be from 2100 UTC Dec. 11th-0100 UTC Dec. 12th. Scoring and bands will be the same as the ARRL RTTY Roundup. Logs should be submitted by Jan. 17th, 1994 to *Bill Eddy NY2U, c/o TARA, 2204 22nd St., Troy NY 12180*.

DEC 18

PERRIS, CA Hams of the Orange Empire Railway Museum will operate KC6TKT and other calls 1900Z-2359Z, to celebrate their annual North Pole Limited Steam Train operation. SSB: 28.330 MHz. For QSL, send QSL and #9 SASE to *OERM, P.O. Box 548, Perris CA 92572-0548*.

DEC 18-19

NAZARETH, PA The Delaware-Lehigh ARC will operate W3OK 1400Z-0200Z Dec. 18-19, from the twin Christmas cities of Nazareth and Bethlehem PA. Frequencies: 3.965, 7.265, 14.265, 21.365, 28.365. For a certificate, send QSL and SASE to *DLARC, RD4, Greystone Bldg., Nazareth PA 18064*.

DEC 30-JAN 1

PASADENA, CA The Relay Repeater Club will operate Station WB6BNJ, from the Wrigley Mansion, Dec. 30th-Jan. 1st, from 1600Z-0200Z each day. Primary frequency will be 28.460 MHz. Secondary frequencies: 21.335 MHz and 14.260 MHz. This event is in conjunction with the 105th Anniversary of the Tournament of Roses. Amateurs in California/Nevada can contact the Station on 2 meters through the 147.21 repeater, on the half hour, or on 220 MHz, via the Condor Connection, on the hour. For a certificate, send a QSL, with contact number and a 9 x 12 SASE with 58 cents postage, to *Relay Repeater Club, P.O. Box 660081, Arcadia CA 91066-0081*.

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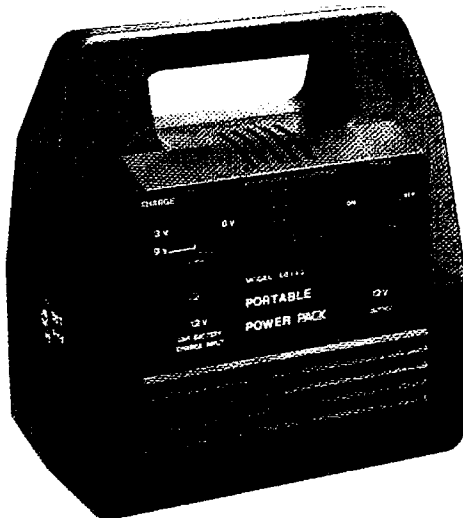
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David Cassidy N1GPH

Peace

It is the time of the year when all the world's peoples contemplate brotherhood, goodwill, and peace. Maybe it would do us some good if we could stop contemplating it and start doing it. The world sure is a mess!

In the last year, the former Soviet Union narrowly missed yet another attempt by the old guard to return to the repressive policies of the past. The people of Russia are still coming to grips with the fact that freedom costs.

The beautiful country of Bosnia (formerly Yugoslavia), host to the Winter Olympics just a few short years ago, has been literally destroyed by religious and tribal bigotry. The faces of the children of Sarajevo tell the story.

Botched policy in Somalia has resulted in the deaths of several American (and other) citizens. We went there in peace to do our duty as the leader of the free world. We saved millions from certain death, and the citizens of Mogadishu have paid us

country have escalated their message with intimidation and bullets. Can you believe this war has been going on now for 20 years?

The current ruling party has decided that the fact that Socialism has failed miserably in Eastern Europe shouldn't deter the United States from giving it a try. Clinton Administration policies (and the fear of what's next) have essentially paralyzed an already failing U.S. economy. In the name of "fairness," the American people appear to agree that they should give up some of their hard-won freedoms. There's enough pork in the barrel for both political parties, so the Republicans cannot claim any philosophical high ground, either.

Are there glimmers of hope in all this? Sure. For the first time since Moses came down from Mt. Sinai, Arabs and Israelis have met and agreed to at least try to live together without bashing each other's heads in. This is peacemaking at its most basic level. These two groups have agreed that the other has the right to exist. It ain't much, but it's a start.

"Once again, the good intentions of the United States are being answered with the barrel of a gun."

back by dragging the dead bodies of American soldiers through their streets.

Haiti is exploding even as I write these words (in mid-October). Once again, the good intentions of the United States are being answered with the barrel of a gun.

The mess hasn't avoided the streets of America, either. The judicial system in the State of California has abdicated its power. The so-called "leaders" of the minority groups living in the Los Angeles area, the very ones who should be concerned with uplifting and providing opportunity for people, are the very ones who make excuses for thugs and criminals. Instead of rule of law, California has instituted rule by mob. Threats of violence and riots seem to be the ways to get what you want out of the California Courts.

This year, for the first time, terrorism reached the shores of America in the form of the bombing of the World Trade Center.

While crimes against tourists are actually on the decrease in Florida, the news media decided to create a crisis so that foreigners are now afraid to vacation here.

The anti-abortion forces in this

My mother is the choir director at her church. When I was young, my brothers and I all sang in her choir. One Christmastime, she taught us a song that is based on The Prayer of St. Francis of Assisi. I'd like to offer the words to this song as my holiday gift to you:

Lord, make me an instrument of your peace.

Where there is hatred, let me sow love.

Where there is injury, pardon.

Where there is doubt, faith.

Where there is despair, hope.

Where there is darkness, light.

Where there is sadness, joy.

Oh, Divine Master, grant that I may not so much seek

To be consoled, as to console,

To be understood, as to understand,

To be loved, as to love.

For it is in giving, that we receive, And it is in pardoning, that we are pardoned,

And it is in dying, that we are born, To eternal life.

No matter what your religious beliefs, the truth is still the truth.

I wish you peace. Shalom.

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

In spite of the decline in sunspot activity, December ought to be a Good month for propagation on the HF bands. The daily chart shows only the 12th and 13th and again the 27th to be Poor days. All the rest of the month will be characterized by many days of decent propagation... the first month like this in a long time. The P (Poor) days may also be accompanied by severe weather conditions.

Of course, you can't rule out an unexpected and sudden disturbance sometime during the month, but it doesn't seem likely except on the days marked P (Poor) or trending between F (Fair) and P (Poor). Times given below are LOCAL times, but the Band-Time-Country chart uses Coordinated Universal Time (what used to be called GMT).

10 and 12 meter bands: Occasional morning openings to Europe, frequent midday openings to South America and Africa, and late afternoon openings to the South Pacific and Australia. Also, short-skip openings during daylight hours between 1,000 and 2,300 miles possible on Good days.

15 and 17 meter bands: Worldwide DX during daylight hours possible on Good (G) days, with bands peaking toward the EAST after sunrise, toward the SOUTH at midday, and toward the WEST during the afternoon hours. Short skip between 1,000 and 2,300 during daylight hours.

20 meter band: Once again, this will be the top DX band for December between dawn and sunset. The band will close earlier than during summer or equinox months, but you can expect excellent daylight DX. Also, short skip beyond 500 miles will be frequent during daylight hours.

30 and 40 meter bands: These bands are expected to open to the EAST during late afternoon and early evening hours, with excellent propagation for DXers on Good (G) days. The band ought to stay open for DX during nighttime hours and close shortly after sunrise. Short skip up to 1,000 miles during daytime and beyond 1000 miles at night, when the band "goes long."

80 and 160 meter bands: You will find much DX and LOW NOISE on many days of the month, with DX peaking toward the EAST around midnight and peaking in various directions just before sunrise local time. Daytime short skip of around 500 miles on 80 meters and over 500 miles at night should prevail on Good (G) days.

On 160 meters, there will be NO daytime propagation, due to heavy absorption of signals by the ionosphere. Occasional DX between dark and sunrise should be possible on Good (G) days, but as always—QRN will be a limiting factor. Short skip up to about 1,000 miles during nighttime hours can be expected... sometimes even when static is heavy.

Grey-line propagation: During the hours surrounding sunrise and sunset (local time) you may be able to take advantage of grey-line skip to the parts of earth in the "fuzzy" areas between total dark and total daylight. Try all the HF bands during these times for unusual signal strength to and from unexpected areas. See you next month, W1XU.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15							20	20A	15		
ARGENTINA	20										15	15
AUSTRALIA	22					40	40				20	20
CANAL ZONE	40	40					20	15	15	15	15	20
ENGLAND	40	40	40	50	40				15	15	20	
HAWAII	20					40	20				15	15
INDIA							20	20				
JAPAN	15							20	20			15
MEXICO	40	40	40	40	40	40	20	15	15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	40	40	40	40	40	40	20	15	15	15	15	20
SOUTH AFRICA	40A	40							15	15	15	20
U.S.S.R.	40								15	15	20	
WEST COAST	15	20	40	40	40	40	40A	20A	15	15	15	15

CENTRAL UNITED STATES TO:

GMT:	20	40	40	40	40	20	20	20	20	20	20	20
ALASKA	20	40	40	40	40	20	20	20	20	20	20	20
ARGENTINA	20	40	40	40	40	20	20	20	20	20	20	20
AUSTRALIA	15					40	20	20	20	20	20	20
CANAL ZONE	20	40	40	40	40				15	15	15	15
ENGLAND	40	40	40	40	40				15	15	20	20
HAWAII	20	20				40	20	20	20	15A	15A	15A
INDIA												
JAPAN	20					40	20	20	20			20
MEXICO	20	40	40	40	40		20	15	15	15	15	15
PHILIPPINES	20						20	20				
PUERTO RICO	20	40	40	40	40		20	15	15	15	15	15
SOUTH AFRICA	20	40	40	40	40		20	15	15	15	15	15
U.S.S.R.	40	40	40					15	15	20		

WESTERN UNITED STATES TO:

GMT:	15	15	20	20	40	40	40	40	20	20	20	20
ALASKA	15	15	20	20	40	40	40	40	20	20	20	20
ARGENTINA	20	20	20	20	40	40	40	40	20	20	20	20
AUSTRALIA	15	15	20	20	40	40	40	40	20	20	20	20
CANAL ZONE	20	20	20	20	40	40	40	40	20	20	20	20
ENGLAND	40	40	40	40	40	40	40	40	20A	20A		
HAWAII	15	20	20	20	40	40	40	40			15	
INDIA	15	20	20	20	40	40	40	40				
JAPAN	15	15	20	20	40	40	40	40			20	
MEXICO	20	20	20	20	40	40	40	40			15	
PHILIPPINES	20A	20	20	20	40	40	40	40			20	
PUERTO RICO	20	20	20	20	40	40	40	40			15	
SOUTH AFRICA	20	20	20	20	40	40	40	40			15	
U.S.S.R.	20	20	20	20	40	40	40	40			20	
WEST COAST	15	20	40	40	40	40	40	40	20A	20A	15	15

Au: Next higher frequency may also be used.

DECEMBER 1993

SUN	MON	TUE	WED	THU	FRI	SAT
			1 G	2 G	3 G	4 G
5 G	6 G-F	7 F	8 F-G	9 G	10 G-F	11 F-P
12 P	13 P	14 P-F	15 F-G	16 G	17 G	18 G
19 G	20 G	21 G	22 G	23 G	24 G	25 G-F
26 F-P	27 P	28 P-F	29 F	30 F	31 F-G	